THE

ELECTRICAL REVIEW.

VOL. LXVI. MAY 6, 1910. No. 1,693.

ELECTRICAL REVIEW.

Vol. LXVI.] CONTENTS: May 6, 1910. [No. 1,693.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address.: "AGREKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

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SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOIVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1910 EDITION

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

STREET LIGHTING.

IT was, of course, but natural that the recent "victory for gas in Westminster" should be seized upon by our contemporaries in the hostile camp as a proper subject for jubilation, and an opportunity to heave half a brick at the organs of the electrical industry—with the greater zest, because such chances are so rare. The rapid extension of electric street lighting, especially since the advent of the flame arc and the tungsten lamp, must inevitably wring their withers, and we need not grudge them the relief they thus obtain.

But it is permissible to inquire whether their elation is as well founded as they would have us believe, and especially whether the contest has been fought on equal terms; for a victory gained otherwise is a moral defeat, and should not weigh upon the spirits of the losers. As we said in our brief note upon the subject, it was difficult to understand the situation, which was totally at variance with previous experience; but an examination of the conditions of the contract throws much light upon the matter.

It is an old saying that possession is nine points of the law, and it appears to be of similar importance in connection with street lighting contracts. We find that the area of which the lighting was under consideration was divided by the Council into four districts; tenders might be submitted for all or any of these districts, but each district was an indivisible unit, so far as the contractors were concerned. The Council, however, could accept any tender in respect of any part of a district, omitting the rest, and could, if it chose, extend the contract to other districts. It will be seen that in tendering under these conditions, the electric lighting companies were seriously handicapped in comparison with the gas company, for while the latter had its mains in every roadway, the former had mains only in parts of the area; the electrical companies, therefore, had to provide against the possibility that they would be required to undertake the street lighting not only where they had mains, but also in places where they would have to lay special mains, with no certainty of obtaining a remunerative return from private lighting. It was even possible that, while having to lay such special mains, they might not receive the contract for street lighting in the areas where they actually had mains already. The question necessarily turned largely, therefore, upon the allowance for capital charges likely to be incurred under the contract.

Further, the conditions for maintenance were extremely stringent; the penalty imposed for failure to maintain the specified candle-power of any lamp was no less than 5s. per day per lamp, an exorbitant charge when applied to incandescent lamps. The gas company asked the Council to reduce this to 6d. in respect of the small lighting units. The failure of the filament of an incandescent lamp would bring this stipulation into action, and the punishment would be immensely disproportionate to the crime; but what the gas company will suffer, if this penalty be faithfully applied—as, in fairness, it must be—can only excite our

pity. It is interesting to note that the Chairman of the Works Committee, Mr. Jacques Abady, one of the principals in a well-known firm, is an expert in photometry, and the photometer specified to be used in determining the candle-power of the lamps bears his name jointly with another. Mr. Abady took by far the most prominent part in the debate in opposition to the proposal to refer back the report of the Works Committee for further consideration, in view of the alarm of the shop-keepers in Regent Street and Piccadilly at the threatened prospect of the removal of the arc lamps in those streets, the former of which was described in the discussion as the best-lighted street in London, and probably in Europe.

While the electrical companies prepared their estimates with a view to covering expenses, it is more than doubtful whether the gas company can say the same. An examination of their figures, in comparison with published results, shows that the price at which they must supply gas to fulfil the terms of their tender must be in the neighbourhood of 10½d. per 1,000 ft. If they can do this and make a profit, it is surely time they reduced the price to their private consumers, who have at least an equal right with the Council to a supply at presentation prices. On the other hand, the gas company may be speculating on the splendid advertisement to be gained. When this consideration arises, all question of comparison is stultified, and the matter is placed upon a totally different footing. That it may be perfectly justifiable, in some cases, to quote an unremunerative price in order to secure the advantage of advertisement, we do not deny; but it is idle under such circumstances to discuss comparisons. In the present instance we think that while the electrical companies have certainly erred on the side of caution, they were placed in a very awkward situation by the conditions under which they were invited to tender, and we do not regard the result as having any bearing upon the question of the relative costs of electricity and gas for street lighting.

It should not be supposed that all the electric lamps in Westminster are now to be abolished; the contract of the Charing Cross Co. for the lighting of the Strand district is not terminable for some years to come, and that of the Westminster Co. for St. George's Parish, not till 1931.

PACKING FOR ABROAD.

We have an urgent message to deliver. Let none whom it concerns rest again until he has considered his own personal position in relation to it. Let every principal ask questions of his responsible officials about it to-day. Let every official at once investigate thoroughly his own duty, and that of his assistants, and see if it is being faithfully and efficiently performed.

Our message has been heard before. We have written it ourselves a dozen times, Consuls have reported it a hundred, and directly aggrieved parties all the world over have uttered it a thousand times and more. Why in the name of reason men do not listen, we fail to understand. Or if they listen, why do they not act? *Who is to blame* for these constant complaints from almost every part of the world whither exported goods go, that all the good work and skill that we may bring to bear in efficient manufacturing and speedy delivery is undone because the goods reach their destination unfit for immediate use, purely because the producer allowed them to be sent out so badly packed that they would not stand rough treatment on the way? What is the reason? We know British manufacturers are not alone to blame in this. But to show that we can do better than some others does not settle the question of our own too frequent inability to do the right thing. Let us find out the real reason if we can. Is the packer—the workman—unequal to his task? Does he know how he ought to prepare sensitive kinds of manufactures for different kinds of transportation and different climates? If not, let those who know teach him. Is it his superior official who has chosen a staff of men whose only qualifications are that they can plane a board or handle a chisel and a hammer, and has set them to a work for which they require a special training? Is it that the official himself does not know what ought to be, what conditions have to be met? Again we say, let us look into this serious question, recognise the failing where we ought, fix the responsibility if we must, but at all costs let us put an end to these constant and wearying complainings in these days when we are all sharpening our steel in the export battle of the world.

Our last reference to this matter consisted of a lengthy treatment of it in our "Notes on Trade Abroad" (August 20th, 1909). We there printed extracts from the paper read at the Calcutta I.E.E. by Mr. Bruhl some seven years ago. It is this paper that is alluded to by an Indian correspondent in some comments received by this week's mail. It is at the urgent request of our contributor that we return to the subject now. Let him speak for himself:—

"The attention of the manufacturer at home should be seriously directed to the question of packing electrical material for abroad generally, and for India in particular. The matter has several times been written about and debated, and a thoroughly sound practical paper was read before the Calcutta local section of the I.E.E. some years ago on the same subject. But for some reason or another things go on in their usual way, and cases of valuable machinery, instruments and lamps, are despatched from home packed in an almost criminally neglectful way. It is a melancholy sight that can often be seen at the discharging jetties of the principal ports. Cases, with the legends 'handle carefully,' 'this side up,' 'sling here,' &c., lying about in all stages of wreck and disaster. One with its sides bashed in like match-wood, another with its ends bulged out and broken, exposing a broken casting, and so on. The first thing to be seen to by the packing head of an engineering shop is that the timber used for packing cases for abroad should be strong enough and stout enough to withstand all possible or probable damage. For heavy packages no planking less than 1½ in. or 2 in. should be used. The second point to be seen to is to fix the machine in its case so that no amount of jolting or upsetting will shift it from its moorings. Where possible, machine bases should be bolted through the case bottom, then fastened round the sides and top with stout wedges and battens. Of course if an electric machine has to be packed water-tight, it should be still more carefully handled, and nails should not be driven from outside through zinc lining. It is questionable whether air and water-tight zinc or other lining, except for delicate instruments, is necessary for ordinary shipments abroad. Many home firms have given up this practice, and on *that* account there is but little to complain of at this side. It is against downright bad mechanical packing that one hears loud and bitter complaints.

"Again, as manufacturers usually charge from 2½ to 5 per cent. extra for packing for shipment, it is not strictly just if they leave subordinates to deal with packing in an off-hand way and trust to luck. The

point against importers in India is that they seldom or never get recompensed for breakages in transit—insurance does not always cover this contingency, and the inevitable reply to a complaint home is that 'our forwarding department assures us, &c.' There is a cast-iron brazing company in Calcutta who reap a rich harvest out of repairing castings broken in shipment—the promoters are wise foreseeing men!"

We trust the foregoing from a man who is in the thick of the fight will lead all who have any responsibility for the packing of machinery and apparatus for exportation, to search out the causes of remissness and remedy them.

Colliery Earthing at the I.E.E.

Although Mr. Wellesley Wood's conclusion, in connection with three-phase mining plants, "that generally an insulated neutral is better where permanent plant is at work and the cables are not liable to mechanical damage," was disputed by the majority of those who discussed his paper at Great George Street on Thursday evening last week, it would be unwise merely on that account to favour the earthed neutral.

It must be remembered that mining conditions are not necessarily text-book conditions, and the ideal of the colliery manager, who must be considered in the matter, not always that of the electrical engineer. Mr. Mountain, whose extensive practical mining experience gives weight to his opinion, agreed with the author, and attributed a large proportion of the troubles in mining installations to the practice of earthing.

To plump for the earthed system "because you then know where you are," while at the same time admitting that colliery earths are not always easily obtained, and that a defective armoured-cable system is much more dangerous than one embodying unarmoured cables, is surely somewhat paradoxical. If one could discount the possibility of mechanical damage, corrosion, and carelessness in connection with a metallic sheathed system, and add to this, certainty in the matter of earths, there would be little to urge against an earthed system; but, with things as they are, the author's conclusions will probably receive the support of many colliery engineers.

Lift Accidents.

The use of lifts in houses, blocks of flats and city offices is daily becoming more and more common. There are lifts of every grade, from the humble luggage lift, by means of which coal and other articles are raised to the kitchen window of a flat, to the automatic electric lift, by means of which all comers may ascend to the top story of a group of offices without employing the services of a lift attendant.

The question must often occur to the minds of those who use these machines, Who is liable if an accident happens?

The question is not by any means an easy one to answer, as it may be presented in many different forms. In the case of Powell *v.* Thorndike, which was decided the other day in the Divisional Court, the question of liability arose in connection with a tradesman's luggage lift provided at certain flats. It appeared that the landlords of certain flats provided, for the convenience of their tenants, a lift for the purpose of raising articles supplied by tradesmen to the various flats. The lift was in the form of a box, with a weight on the top, and was pulled up and down from below. It ran outside the building in iron guides, and communicated with the scullery windows of the flats, and it was the landlord's duty to keep it in repair. The plaintiff, a servant of one of the tenants of the flats, was, on December 1st, 1909, signalled to go to the lift, and she accordingly went to the scullery window, and was in the act of taking out some articles from the lift when some one pulled it down, with the result that the top of it struck her on the head and injured her. In an action claiming damages from the landlords in respect of her injuries, it was alleged that the landlords were negligent in having constructed and maintained the lift without the means of keeping it stationary at a window. Evidence was given that on the day in question the lift was not out of repair, and that it had been in use for eighteen years without any accident having occurred. The jury found that the landlords were guilty of a breach of duty in supplying and maintaining a lift which was a source of danger to those likely to use it, and judgment was entered for the plaintiff. On appeal by the landlords, it was held that the landlords had not been guilty of any negligence, and that the plaintiff could not recover.

In the case of a person visiting a friend at a block of flats, who sustains injury in a lift, a difficult question would arise as to whether the action should be brought against the landlord or the tenant. If the lift was provided and maintained by the landlord, it would seem that the liability would be upon him. If the accident was due to the negligence of the lift-man employed by the landlord, the liability would certainly fall on the landlord. The same principle would apply if the lift was an automatic one self-controlled.

Reducing Fuel Consumption in Electric Generating Stations.

A correspondent of the *Engineer* shows the advantage gained by the steam turbine over the reciprocating engine, owing to its ability to profit from good "vacuum." He does not, however, lay stress on the principal reason for this ability to profit by high vacuum. It is not that there is anything in the principle of the turbine, which, after all, is merely a contrivance to get work from expanding steam; it is largely a commercial question—this superiority of the turbine.

The turbine may be likened to a reciprocating engine with the whole area of the low-pressure cylinder thrown open to the condenser. The ports and passages of a reciprocating engine are too small to take advantage of a good vacuum. It would cost a great deal to make much larger exhaust passages, and it would cost a great deal to make the low-pressure cylinder large enough to carry expansion to condenser pressure, for the ports and passages might be made bigger to reduce the back pressure on the piston, and there would still be a drop in the pressure when the exhaust-valve opened, producing idle expansion, unless the cylinder were made larger. It is so much easier to make a final large end to a turbine that cost is less serious.

The author of the article pleads for drainage or drying of the exhaust of a reciprocating engine when delivering to a turbine. He gives 0·875 as the probable dryness factor of the exhaust. An engine, he says, gains more than a turbine by superheat up to 200° F., and his argument is for superheated steam supply to an engine which exhausts to a turbine. A 27-in. vacuum can usually be got from an existing condensing plant without great modification. Less than 2 per cent. gain is made by increasing the vacuum from 26 in. to 27 in., and only 2½ per cent. is gained in raising 27 in. to 28 in., while the latter would probably require new condensing plant.

There are many points to be advanced in favour of combination working of reciprocating engines and turbines. Whether the movement will be permanent remains to be seen. At present it is a very useful makeshift, and reminiscent of the Lancashire methods of 50 years ago, of setting little high-pressure horizontal engines to exhaust into the old weakly-built beam engines, whereby these were given a longer lease of life by the reduction of stresses brought about by the compounding. Then the McNaught system was a similar makeshift which did very well indeed—so well, in fact, that it became customary to build new engines on the McNaught plan, just as now turbines and reciprocating engines are built new for co-operative action; and history is but repeating itself in this matter of compounding.

D

MECHANICAL DEFECTS IN MINING MOTORS.

[COMMUNICATED.]

In mining electrical engineering a good many of the difficulties which are encountered may be classed as accidental or unique; that is to say, they owe their origin to circumstances which cannot be systematically foreseen or guarded against. At the same time, no mining engineer of any considerable length of experience will dispute the fact that there are a large number of troubles, both electrical and mechanical, in motors which appear to recur with such frequency, that one is tempted to inquire whether some system of classification of such troubles cannot be attempted, and whether makers of such motors seriously consider the defects which users point out to them from time to time. It is possible, of course, that those who do the buying on behalf of some mine owners accept the lowest offer irrespective of quality or workmanship; but, in view of the growing importance of mining electrical engineering, it is to

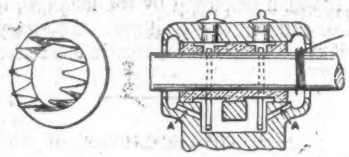


Fig. 1.

be hoped that such conditions of things will not much longer be in existence. Electrical breakdowns in mines have been much discussed of late, and it may, therefore, not be out of place to draw attention to some mechanical defects, many of which can be eliminated by proper care in designing.

In a recent discussion at a meeting of the Institution of Mining Electrical Engineers, it was stated that out of 80 breakdowns which were reported, 15 per cent. were caused by mechanical contact being made between the fixed and revolving portions of machines. It is more than probable that the majority of these breakdowns occurred in three-phase motors, where the clearance between the stator and rotor is necessarily very small, and consequently any lack of alignment in the shaft soon causes the gap to be reduced to zero.

The first and most important cause of this is excessive wear in the bearing bushes, and as is frequently pointed out, this can only be detected by periodical inspection. Unfortunately, however, this inspection is with many machines not so easy as it at first sight appears. The construction of the end plates of an induction motor is often such that inspection can only be made when the motor is stopped, and this point is of great importance, inasmuch as the wear may equally well occur at the sides or top of the bearing as at the bottom, and the gap, when the machine is running, is then quite different to that which the machine has when standing. The part of the gap to be closely watched is clearly that which lies on the diameter where the maximum pull or thrust of the shaft takes place, and whereas a feeler gauge can be used to detect any wear due to the weight of the revolving part when the machine is at a standstill, such gauge cannot be used when the machine is running. In order to trace any danger due to side or top wear the simplest method is to place a lighted glow lamp at one end of the air-gap and to sight it from the other end while the machine is running, with the room darkened.

If makers of induction motors would remember that such testing underground is of necessity more difficult than in a workshop, and would design the end plates to allow of easy inspection along the lines indicated, one of the difficulties would be removed. This question of air-gap clearance is a most important one in mining motors. It is, of course, quite easy to build a very cheap machine by reducing the air-gap unduly, and consequently it is a point worth mentioning in any specification drawn up for mining motors. If other things are equal, it should be remembered that the maker specifying the greater clearance between stator and rotor should have the preference in placing the order.

The next point which arises is the way in which electric mining motors should be maintained under working conditions, provided that a reasonable clearance between stator and rotor is given at the commencement. The question of efficient lubrication will be dealt with later on, but it may here be mentioned that it is practically useless to cut oil grooves in the bushes at the part where the maximum pressure takes place, as is so frequently done, since the oil will not feed into such parts in a proper manner unless it is placed under pressure. The bearing bushes should be well fitted in the end covers of the machine or in the pedestal, and should be sufficiently strong to resist the strains induced by fastening them with a set screw or screws without becoming eccentric when tightened up. Cases have frequently occurred when bushes have seized hard on the shaft due to their eccentricity, shorn the set screw away and revolved with the shaft before they attracted attention. The practice of using cast-iron bushes lined with white metal is fast dying out, and, as a rule, in well-made machines brasses are fitted.

Nearly all modern motors are now made with their end plates turned so as to fit centrally in the motor frame with a spigot and socket joint; but even at the present time some machines depend on the good fitting of the set screws which hold the end plates in position. Even with the former arrangement it is quite common to find that when the motor has been dismantled and re-erected it is difficult and even impossible to see that the armature or rotor is centrally placed with the frame, although it would appear to be comparatively simple to provide for sighting through or using feelers in the air-gaps from either end.

Difficulties in the lubricating arrangements are not so uncommon as might be supposed. Perhaps the most troublesome point is an inefficient oil thrower, allowing the oil to creep along the shaft to the pulley pinion or coupling, or even into the rotor windings. The trouble in the windings does not occur so largely from the oil itself as from the dust and dirt which it collects. Fig. 1 illustrates a simple and effective contrivance for reducing this trouble in cases where it is not possible to re-turn the oil thrower on the shaft itself. The device consists of a thin metal disk fitted carefully on the shaft just inside the bearing and bound tight with copper wire. The holes A in the bearing, indicated in the sketch, are frequently too small to allow of the oil getting back into the well as fast as it comes through the bush, and in this connection it should be remembered that some bearings always run warm to a greater or less extent, and consequently the oil is distinctly thinner at the end of a day's run than it is at the commencement.

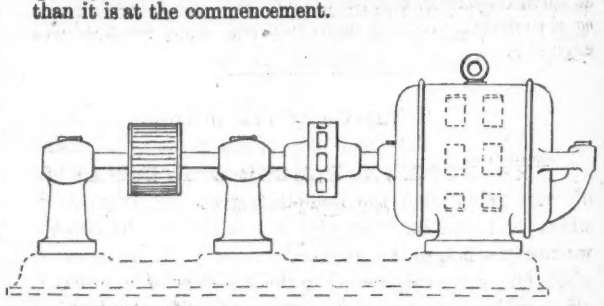


Fig. 2.

It is a frequent experience to find that a pool of oil has collected in the bottom of a motor casing, and it is surprising that more efficient means have not been adopted to counteract this trouble. It would appear that it would be a simple matter to drill a couple of holes in the casing to drain the oil away, and a simpler remedy could not be devised. In the case of a totally enclosed machine the drainage holes can be provided either with taps or plugs, which would be opened to drain the oil only during inspection.

The difficulties above referred to are accentuated by the inaccurate setting of a motor on the bed-plate, by want of careful levelling, or the existence of a spring in the bed-plate due to insufficient metal to carry the weight. Concrete or stone foundations are not always possible in underground situations, and, therefore, machines are often set on timber baulks; but it should be remembered that these in course

of time swell with the damp which is present, so that if the base-plate is of a somewhat light construction, the levelling of the machine is soon upset. The same trouble is also experienced when motors are used in order to replace steam or compressed-air machinery, and the base-plate fixing is of a makeshift character. An excellent arrangement, particularly for large machines, is that shown in fig. 2, which illustrates a motor driving through a flexible coupling. It will be seen that the short shaft carrying the pinion or pulley is mounted in two separate bearings, and therefore takes all side pull or thrust and also any end pressure. The revolving armature or rotor is thereby relieved of any strain calculated to throw it out of centre, and is only required to give an even turning effort. Incidentally, the arrangement has the advantage that the machine is easily disconnected mechanically for testing purposes or for the substitution of its spare, and it therefore enables a standard shaft to be used whilst giving the advantages of an outer bearing.

Another difficulty which is commonly met with in mining motors is the exposure of the core plates adjacent to the ventilation space. For mining work, where damp and dirt are the rule and cleanliness is the exception, ventilation is the best machines is through the ends only. The main casing has no inlets or outlets, as shown in dotted lines in fig. 2, and consequently dripping water or falling dirt is excluded from the windings. The arrangement costs a little extra, but is well worth the increased outlay.

In most mines vermin, such as rats and mice, are to be found, and motor casings should be fitted with wire or gauze protectors in order to exclude them. This is necessary for two reasons, the first being that they eat off the insulation from the windings, and the second, that they creep into the frame at night whilst the machine is warm after the day's work, and unless they are out when the current is switched on, they are liable to short-circuit the exposed conductors. This precaution, although comparatively simple, is one that is rarely taken unless the buyer insists upon it, but those familiar with mining work will agree that rats, mice and black beetles are found in abundance in some pits, and the trouble indicated is a real risk.

In the above notes no attempt has been made to treat the subject of mining machinery from a theoretical standpoint, although much might be written from the point of view of adequate protection, the question of rating for overloads, and other matters which are at present exercising the minds of mining engineers faced with the problems raised by the new means of power in collieries. It is, however, hoped that a practical statement of a few of the troubles which have been found in connection with motors installed in mines will be of assistance to engineers who have to deal with colliery equipments in a practical manner.

THE RUSSIAN ELECTRIC RAILWAY EXHIBITION.

We have received this week some printed literature in English relating to the exhibition which the Imperial Russian Technical Society is now organising. It is to be held in St. Petersburg from August to November next, for the purpose of showing to the engineers, authorities, and others interested in the subject, what is being, and can be, done in the direction of working railways by electricity. There will be three sections, as follows :—

1. Applications of electricity to steam railways.
2. Electric traction ; (*a*) on main lines ; (*b*) on light railways ; (*c*) on tramways.
3. Utilisation of waterfalls for such purposes.

In order that comparative trials of electric locomotives and motor cars may be made, the Committee of Organisation will lay a special track (4 ft. 8½ in. normal gauge) 2 miles long, whereon will also be demonstrated the working of electric traction with different kinds of current. A report is to be made to the Government on exhibits of special interest for Russian requirements. There have come to hand copies of the programme, rules for exhibitors, and the statutes of the exhibition, and we would urge British electrical firms who desire to take an interest in what promises to be a very important event, with considerable consequences in regard to the course of future business, to procure copies from the Committee of Organisation, International Exhibition of Electricity Applied to Railways, Panteleimonskaja Street, 2, St. Petersburg.

The main classifications in the three classes mentioned above are as follows :—

1. Signalling : block, telegraph and telephone ; electric lighting and power transmission in railway stations and workshops ; electricity applied to rolling stock (including train lighting, lanterns, ventilation of cars, electric brakes, &c.) ; different applications of electricity to railways.

2. *Main lines* : Permanent way ; rolling stock ; elevated conductor construction ; electric transmission ; generation of energy ; independent electric locomotives and motor cars ; exploitation and statistics ; projects of electric main lines in Western Europe and America ; projects and surveys of electric traction main lines in Russia.

Tramways : Permanent way ; rolling stock ; elevated conductor construction ; transmission and distribution of energy ; generation of electrical energy ; car-sheds and workshops ; auxiliary equipment ; exploitation and statistics ; general data ; projects of tramways in Russia.

Light railways (electric) : Independent light railways ; suburban lines of steam railways ; industrial electric railways ; railways in mountainous countries ; mono-rail and rail-less electric lines.

3. Electro-hydraulic plants ; hydraulic machines : exploration of water powers ; study of water-power utilisation in higher technical schools.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electricity in Mines.

It is with very great pleasure that I note your remarks in your issue of April 22nd with reference to electricity as applied to mining. There is one suggestion I should like to make, and that is that the electrical engineer, who ought to have full charge of the electrical plant, should have the same qualifications as recommended by you with reference to electrical inspectors, with the exception that the time of probation be reduced to about six or seven years. I should think that, after this time has expired, any electrical engineer ought to have become quite familiar with the requirements of a mine, and, in fact, become a good pit man ; during this time he will have had the opportunity of making some hundreds of visits down the mine to attend to the electrical machinery, extensions, &c., and will then be in a position, knowing the requirements, to take full charge.

With reference to the article by Mr. T. Campbell Futers, many of his suggestions are similar to what I put forward some time ago in the "Correspondence" in the Electrical Review, but with all due respect to him, there is one thing I disagree with, and that is the mechanical engineer having full charge of the electrical plant. Now, what is the reason of this? Are electrical engineers no good? He says the very worst economy is to cheesepare by employing cheap men. To give the mechanical engineer full charge sounds all right to those not knowing the requirements of a colliery, but to other people the idea is absurd. I am going to give a few brutal facts, but still true, knowing the ropes as I do, having been employed in and about mines for the last 20 years. How many really good mechanical engineers are there employed at collieries at the present time? My own experience is, not many ; there are some, but the number is small compared with the number of collieries in operation. How many of these so-called mechanical engineers have graduated from blacksmiths, joiners, and shaftmen, to the coveted position of colliery engineers? An untold number. Are these men also capable of taking charge of a colliery electrical plant? I say no. The fact is, they will take charge of anything, from a wheelbarrow to a traction engine, so long as somebody else takes the blame. I have been among them ; I know what they are. To hear them talk, "I have done this," "I have done that," "I have full charge of our elec-

trical plant," one would think they were Kelvins or Nikola Teslas.

I have sometimes asked them, Have you an electrician? The answer generally is, "Yes; very fair man, you know—does his work very well, but one must watch him, you know." I know where the watching comes in; the electrician teaches him to a certain extent, without being aware of it. What the electrician will not teach him by fair means is got out of him by foul, and I defy anybody to contradict my statement. After this, the enginewright, or mechanical engineer so termed, starts to teach the electrician; if he does not follow out his ideas he gets kicked out, and another is put in his place.

Then you wonder at accidents. I don't; ever since electricity has come to the fore in mining work this type of engineer has viewed its progress with a great amount of jealousy. It was something he was not familiar with; the men who were engaged to look after it were treated, and still are treated in many instances, little better than serfs. They did, and are still doing, the work, and he gets the credit for it.

Many manufacturers like this type of men; do you know the reason? If you don't, I won't tell you; but I will say this, that this is the kind of thing that has done much to bring discredit upon an honourable profession, and especially in mines. Have these conditions altered, and I prophesy a brilliant future for electricity in coal mines.

But to suggest that the mechanical engineer should have charge of the electrical plant—if this is not cheeseparing, I don't know what is. Why don't the Electric Lighting Committee of a supply undertaking put into power the waterworks or gas engineer?—it would save some considerable expense, and be beneficial to the electrical plant. It would be quite proper to put the electrical engineer under him! This is the bad state of things at the present time. I say, let the colliery electrical plant be under a separate engineer; let him be responsible for the upkeep, management, testing and repair of the same, and let the colliery mechanical engineer look after his cages, ropes, guides and other tackle, and he will have plenty to do.

I must say that the present colliery electrical engineer has something to look forward to if this nice state of things is allowed to continue. Take, for instance, the case of a colliery electrical engineer who starts with a very small plant; he keeps adding bit by bit until the plant grows to about 800 KW. He has erected the whole of the machinery himself, been responsible for the buying of various kinds of motors, been in charge, say, nine years, never had an accident, kept the machines in good order and repair, and instructed every man in his duties; everybody from the management down to the smallest pit boy both respects and likes him, knowing that he has their interests at heart. Then the law is adjusted so that this man, after many weary hours of toil, study and anxiety, is obliged to hand over the management of his electrical plant to the mechanical engineer, and assume a position of serfdom, for it could be nothing else if the mechanical engineer had a spite against him due to his former position.

This would be un-English. It is this state of things that is to blame for many accidents, the colliery enginewright being in charge, and the electrical engineer not being able to do what he knows should be done.

I know of a few cases where the colliery management would sooner trust to the judgment of the electrical engineer than to that of their present mechanical man, and where the electrical engineer has seen three enginewrights come and go, because they were only poor tools for their own kind of work.

Now we have the Institution of Mining Electrical Engineers to improve the status of the colliery electrical engineer. Has it done so? Will it do so? Or rather is it not trying to improve the status of the colliery enginewright? Colliery electrical engineers, take warning in time; you are digging your graves, and the colliery enginewright will be the man who will erect your tombstone. Take him to your heart, make a confidant of him, give him the benefit of your experience and knowledge, and he will repay you by assuming full command. Then where will you be?—where you are now. In the dirt, where you deserve to remain if you still continue to be Mary's little lambs, and, to crown all, give the enginewright a diplomaship; it will tend to improve your position at the colliery!

I know there are a lot of you who read this who will not be pleased, but I cannot help that. I am giving you my views as I can see things shaping themselves for the future, if you are not careful.

With reference to the electricity bogey in mines, I do not think miners, or anybody else, need fear using electricity in mines if reasonable precautions are taken, and the Government insist on the conditions being made suitable. Electricity is not to blame so much as the conditions under which it is used. Take direct current, for instance. I consider direct current under suitable conditions every bit as safe as, or more safe than, three-phase current. All the three-phase people can talk about is the danger from sparking commutators. The most modern coal-cutting machine, using direct current with its broad planed joints, is just as safe from a fire point of view as a three-phase machine. From a shock point of view, I would sooner have a 500-volt direct-current shock than a 250 alternating. And again, we must allow that the direct-current coal-cutting machines mostly use carbon brushes; taking this into consideration, I do not think it probable that any explosion can occur in a totally-enclosed motor when the use of carbon brushes produces carbonic acid gas.

In every colliery electrical installation, all cables should be kept completely insulated from earth; for preference single cables should be used, that is for three-phase three separate cables. Now we are allowed to earth the neutral wire of a three-phase system of supply; we are also taught that anything from 100 volts upward must be considered dangerous; yet we earth the neutral wire of the system, so that it needs only one of the outer wires to come into contact with the framework of a coal-cutting machine to give a man a shock, in some cases fatal. Why not have all three cables as I have mentioned? If one cable should earth there is no danger, providing the other cables are in good condition; the fault will be shown on the instruments at the surface, and should be attended to at once.

I do not see any more danger in a man getting a 500-volt shock than a 200, if a 200-volt shock will kill him. I would much rather run the risk of a man getting a 500-volt shock, once a week, say, than getting a 200-volt shock three or four times a day. Taking a direct-current two-wire system, both mains completely insulated from earth, should a fault develop on either the positive or negative side, the machine men do not get any shock, but we know of it at the surface by means of two voltmeters, which are kept coupled up across the mains with the middle wire earthed. Earth or ground lamps are no good for this purpose, as they require a certain amount of current. Should any of our voltmeters read 80 or 90 volts on either side to earth, then we find out where the trouble is; our coal-cutter framework is not earthed either for this purpose, and the conditions in most places are dry.

Talking about sparking commutators, with a well-designed motor, this is all nonsense. I have a large 120-H.P. interpole shunt-wound motor, taking about 220 amperes at 500 volts. I will give £5 to any one who goes down our pit and finds a sign of a spark. This motor is working, day, afternoon and night all the week through, taking this current, and, manufacturers please note, this motor was made in Germany.

I think it absurd to earth a motor frame that is mounted on a wood foundation, with a wood floor for the man to walk upon, and no danger of his coming into contact with the earth at all. It used to be possible under our old conditions in all our large motor rooms, with the motors mounted on wood, and 1 in. of cement on the floor boards under the motor to make the thing something like fireproof. It was our custom some six years ago to do this. It used to be possible to stand on the framework under the above conditions without getting a shock; also to handle separately any of the brush-holders or spindles, still standing on the framework. We also used to have earth lamps coupled across the terminals of the motor with the middle wire coupled to the frame, so that if the insulation of that particular motor broke down, either on the positive or negative side, the same was shown by means of the lamps, without affecting any other motor in the mine. I regret we cannot do this now, using one common earth, and if one motor goes wrong

by earthing, it puts a considerable strain on the insulation of the others, under the new conditions. Not so under our old conditions. My idea is, if you have no earth, why try to earth?—there is no danger in not having an earth, but there is a very great danger in having a partial earth.

If the law compelled mine managers to build proper engine rooms for permanent electrical machinery, with the motor and the man well insulated from earth, we should not have so many accidents. This could not very well be applied to coal-cutters, but under the above-mentioned conditions, that is, with both mains completely insulated from earth, coal-cutting machinery is quite safe. I believe this custom prevails in New South Wales in reference to permanent electrical machinery.

Earthing, I am afraid, is a very cheap way for the colliery manager; he is not put to the expense of a proper motor room—any old road end will do, so long as the framework is earthed; good, bad or otherwise, he does not care. Under our old conditions of working, I dare lay myself open to imprisonment for life if any man standing upon the framework of our motors, and coming into contact with any brush spindle separately, got a shock due to the other motors earthing in any part of the mine. I dare not say that under the earthing system; if any other motor in the mine earths, say, on the negative side, and I should come into contact with the positive side of another motor in another part of the mine, and I am standing on dry wood with my hand resting on the framework, I get a hand-to-hand shock, which I consider more dangerous than one from hand to feet.

I should also like to say to managers, give your electrical engineer a bit more authority; it will pay you. Also give him credit for his good work; do not take it yourselves.

I regret very much to note that many managers think that they know all that is worth knowing about electricity, and try to pose as electrical experts. To hear them when they are among themselves, bragging, is amusing. "I have done so and so, and so and so; I am afraid America is going backward." In most cases the despised electrical engineer has taught them all they know, similar to the enginewrights. This is one case where Justice seems to have lost herself. A mechanical engineer of such a place has had everything electrical put down to his ideas and design. In fact, he designed all the electrical machinery; the electrical engineer who actually did the work, gets no credit at all. This state of things wants altering badly, and managers ought to be satisfied with a reasonable return, and not to be so grasping, and not to try and fix the blame in the wrong place. If this state of things continues, the only thing that remains for the poor colliery electrical engineer is to join hands with the Miners' Federation in order to get his dues and demands.

Ivanhoe.

Westminster Street Lighting.

Referring to the article which appears on page 656 under the above heading, and in which you assume that the prices quoted by the electrical companies were unduly high, you appear to have neglected the fact that the maintenance price quoted had also to bear a large proportion of the capital outlay. This becomes apparent if attention is given to the varying prices for the 5, 10 and 15 years for which we were asked to quote; in the case of this company the expenditure on mains and reinstatement alone to provide the necessary lighting in our area amounted to nearly £8,000. There is practically no capital liability in the case of the gas companies, for not only have they got their mains laid in all the streets in which public lighting is required, but in by far the majority of cases they are already connected to the lamps; and again, referring to the comparative difference in the price, it is obvious, by ordinary deduction, that the Gas Co.'s quotation for the supply of light is very considerably below the cost of production, and can only be regarded as an advertisement on their part, to which purpose, of course, we take no exception so long as it is made clear that the lighting will be carried out at a loss.

Charing Cross, West-End and City Electricity Supply Co., Ltd.

H. W. Kingston, *Engineer-in-Chief.*

London, W.C., *April 28th*, 1910.

Trans-Atlantic Wireless Telegraphy.

We have read the editorial note in your issue of April 29th, entitled "Trans-Atlantic Wireless Telegraphy," and thank you sincerely for your good wishes for the success of our service.

With reference to the penultimate paragraph of your article, however, I am to say that the fullest inquiry in our offices has failed to elicit what "manager of the Marconi Co." is referred to; and I am also able to assure you that no responsible official of the company would have made the statement to which you properly take exception.

Marconi's Wireless Telegraph Co., Ltd.

W. W. Bradfield, *Deputy Manager.*

London, W.C., *May 2nd*, 1910.

[We have great pleasure in publishing this letter, and in withdrawing our comments on the statements referred to, so far as they reflect upon the conduct of the management of the Marconi Co. Unfortunately some such remark apparently was made by some person, for it was reported in more than one of the daily papers; but we are glad to learn that it was not authorised by any responsible official.—Eds. E.R.]

Inspection of Coal Mines.

With reference to the letter under above heading by "P. A. D.," I do not think his reasons are by any means strong enough to carry his opinion that additional inspectors are unnecessary.

I would like to read his replies to the following questions:—

1. How many collieries in the United Kingdom have electrical installations?
2. What percentage of these are insured?
3. Of those insured, what percentage keep a record of insulation tests?
4. How often do insurance inspectors test for insulation themselves?
5. In what percentage do the insurance companies insist upon a *thoroughly* competent man being in charge of the plant?
6. What percentage of inspections are surprise ones—that is, without advising beforehand, and so enabling electrician to be prepared for them?

I cannot see any comparison myself between an insurance inspector and a Government inspector, especially as to the carrying out of the Home Office Rules, more especially as I happen to know of cases where insurance companies have wilfully evaded them in specifications for new plant.

Without wishing in any way to depreciate insurance inspectors, there is no doubt whatever that pitmen generally would feel more confidence in visits by Government inspectors than by insurance men, and as regards the question of taxation, what would this amount to per head?

I think "P. A. D." would be nearer the mark if he were to express his fears that if more Government electrical inspectors were appointed he might lose his job, as a good many colliery proprietors would give up insurance of their electrical plants if they knew that the inspection of their plants came more directly under the supervision of Government experts.

Colliery Electrician.

I expected more correspondence on the above subject, after reading your suggestions in your issue of April 22nd, which I thoroughly endorse. With regard to the reasons against by "P. A. D.," the writer's experience has been that the extent of an insurance inspector's interest is limited to the particular unit that happens to be insured by his people, very often only moving machinery. Again, it would not be necessary for a Government Inspector to make so many inspections, for by the Mines Regulations he would be notified within three months of any new plant installed. If, then, an inspection was made, and the whole job thoroughly tested, it would be reasonably expected that it would go for 12 months. But I think the fact of a "Government Inspector" being on the spot, as it were, would be conducive to the

improvement of a great many existing installations. With regard to the extra taxation, I think that even "P. A. D." would freely pay if he thought it might prevent a repetition of the West Stanley affair, which, in the writer's opinion, it certainly would do.

F. W. A.

St. Helens, Lancashire,
May 2nd, 1910.

India-Rubber Gloves for Extra-High-Pressure.

In reply to Messrs. J. G. Ingram & Sons, my experience leads me to agree with Mr. Mountfort's evidence concerning rubber gloves, though I would qualify the remark, "a rubber glove is no *reliable* protection against 6,000 volts."

In the first place, the glove is tested, according to Messrs. Ingram, to give a guaranteed factor of safety of only 1·7, or, if specially ordered, 2, 3 or more. This figure of 1·7 is dangerously reduced by gripping a live conductor, the rubber at that point becoming somewhere in the neighbourhood of half its original thickness, and by minute cuts or scratches, which may be overlooked on examination, caused by handling rough articles.

In such cases, where it is absolutely essential to work on a live H.T. conductor, a thick rubber mat should be used in addition to gloves, the former being much less liable to become seriously injured and its insulation resistance being considerably higher.

After using rubber gloves safely for some time, a sense of false security is obtained, and the factor of safety, already low, may at any time be brought below unity by one or a combination of circumstances, such as a firm grip with a slightly damaged glove, or torn rubber through a sharp point and a hasty movement, with the result of still another unfortunate fatal accident.

Every Precaution.

Your issue of April 22nd, p. 655, reported a Coroner's dictum that "Rubber gloves are no protection against 6,000 volts."

Your issue of April 29th, p. 681, publishes a letter from J. G. Ingram & Son, stating that they make and test rubber gloves up to higher pressures. Therefore, the Coroner's statement surprises them. The fact is, that it depends on circumstances.

A rubber glove may be tested up to 6,000 volts and used with safety at that pressure on operations that will not abrade or compress the rubber to a lessened thickness between the flesh and death. But rubber is easily abraded or punctured, and more easily compressed. Only a few hours' wear on some jobs may affect a rubber glove sufficiently for the purpose of another inquest.

This fact has been recognised by this company for some time past, and they have made and supplied largely to collieries, rubber gloves tested up to 10,000 volts, *faced with leather* on the palms and on the fronts of the fingers.

The advantage of this protection on the wearing parts is obvious from the point of view of economy in longer wear, and, most important of all, increased personal safety.

St. Helens Cable and Rubber Co., Ltd.
J. H. Brooking, *Manager.*

Warrington, *April 29th*, 1910.

Electrically-driven Ring-spinning Frames.

Under the heading "Apparatus for Textile Factories," you describe in your issue of April 29th a system of driving ring-spinning frames, which you state the Oerlikon Co. have recently introduced from the Continent.

We regret having to point out that, so far from this being the case, the system described is nothing more than a copy, in all essential respects, of what is known in Lancashire as "The Brown-Boveri System of Ring Spinning."

Our system of ring spinning was shown working for the first time in this country in October, 1908, at the Manchester Exhibition, and the two ring frames shown at work there at continuously varying speed made a great impression in textile circles at the time. We had previously published in the *Textile Manufacturer* the whole theory upon which our system is based, while since then we have published many articles and brochures on the subject, some of the latter being already in their second edition. The description published by you of the Oerlikon Co.'s so-called "new system" might well be an abstract of one of our own publications, as far as all essential points are concerned.

The Vulcan Mill, Bury, was the first mill in this country to adopt our system of driving for ring frames, and this installation was followed by a number of others. In various foreign countries many mills have been equipped, and altogether some 1,500 motors of the type in question have already been put to work. As, in addition to this, the Lancashire Dynamo Co. have been licensed by us to build these motors, this system of working, although quite new to this country when we introduced it in 1908, is certainly no novelty to anyone to-day.

The speed diagram given in fig. 7 of your article is simply the speed diagram of our system as usually applied, and the means of producing it are fully covered by our patents in the most important countries of the world. Your columns, however, are not the place to deal with this aspect of the matter.

We may note, in conclusion, that the motor illustrated in your article, and described as a special three-phase motor, is not a three-phase motor, but an ordinary single-phase repulsion motor.

Brown, Boveri & Co., Ltd.
A. C. Eborall, *Managing Director.*

London, S.W., *April 30th*, 1910.

[That the system of varying the speed of ring-spinning frames during the process of spinning, which originated in this country over 30 years ago, was brought to a practical success by Messrs. Brown, Boveri & Co., we believe, is beyond dispute. We published an illustrated description of their system in our issue of August 23rd, 1907, and described the Manchester exhibit in our issue of October 2nd, 1908; we have also referred to it on other occasions. The question whether their particular system is adequately covered by letters patent is, of course, beyond our province; but Messrs. Brown, Boveri & Co., Ltd., in their attitude of astonishment at the alleged copying of their system, appear to exhibit a degree of *naiveté* rather unusual amongst engineers.

Inventors have a way of walking in each other's footsteps; and if one electrical firm successfully carries into practice a process invented many years ago, but previously unused, is that a good reason why another electrical firm should refrain from employing the same well-known process?

We are obliged for the correction at the end of Mr. Eborall's letter: the motor is, of course, of the repulsion type.—Eds. E.R.]

Cleaning Accumulators.

Can any of your readers kindly inform me whether they have ever removed deposit from the bottom of accumulators by means of a hand pump? If so, will they kindly let me know the maker's name?

W.

The "Orb" Switch.—Messrs. George M'Cartney and Co. are makers of the "Orb" switch and fuse specialities, which are of the water-tight class specially adopted for the severe usage of mining, shipyard, and similar installations. Two, three and four-pole iron-clad main switches for A.C. and D.C. circuits, the "Orb" switch-fuse, also iron-clad, quick-break main switches of ordinary pattern, tubular replacement fuses, &c., are listed by the firm, who also build complete switchboards and motor panels, and a number of cheaper switches more particularly for motor work and of the water and dust-proof pattern.

Electricity Supply Poster.—We have now received a sample copy of the showcard and poster which is being used by the electricity supply authorities of London and suburbs for popularising electric lighting, as the first step in their publicity organisation scheme to which reference has been made in our pages on several occasions recently.

LEGAL.

THE ELECTRICAL CO., LTD., *v.* THOMAS, SON & CO.

THE hearing of the above case concluded this week before the Official Receiver (Mr. Pollock) in the High Courts. It has lasted 40 days, and has established a record in respect of cases before the Official Referees.

Further evidence was called by the plaintiffs in answer to the counterclaim, and MR. CHAS. P. SPARKS, examined by MR. ABEL THOMAS said he was a member of the Institution of Electrical Engineers, and also of the Institution of Civil Engineers. He had been a consulting engineer for 10 years. He had had a considerable experience of electrical machinery used for power plants in collieries. Witness visited the Llynvi Colliery in 1908 at the plaintiffs' request, and examined the plant there. He found steam being raised by two boilers, and a single generator driven by a horizontal engine which was supplying power to a pump in the "slant." There were two other pumps installed, one of which was also running. The first pump was a Vigoi Mouski, the second a three-throw Uskside, and the third an Allen pump. The Mouski was being driven by a motor. The plant was suitable for the work, but he had advised the plaintiff company that there were not sufficient reserves. There was no spare generator, and the pumps were not arranged in the slant to the best advantage. In his opinion it was practically impossible to sink a drift without a reserve pump.

COUNSEL: But it was done?—Yes, it was done, but no contractor would undertake to repeat what the Electrical Co. did. The sump, continued witness, was very much smaller than usual, and the danger was of losing the machinery through it being drowned out.

Now will you assume that the exciter, which had been for some time on the generator, failed, was repaired, and ran without trouble for about ten days; what, in your opinion, would have caused the failure of the machine to excite?—Probably the brushes were allowed to get loose or the machine to get dirty.

For what other reason would it have failed to excite if it had been worked properly and used properly?—I do not know any other reason. It was very necessary to have a skilled man to work the plant. In the early days, when it was very difficult to get a skilled man, trouble with the commutator was far more important than it is at the present day.

Do you often have trouble with commutators and exciters when you have good men to look after them?—I have not heard of trouble, with this exception, for a great many years.

Cross-examined by MR. WILLIAMS, K.C., for the defendants: In other words, whatever business you are dealing with if you have got skill you diminish the difficulty?—Undoubtedly.

I suppose if you put an unskilled man to manage an aeroplane there might be danger?—Yes, great danger.

Further cross-examined, WITNESS said he knew the plant which plaintiffs had supplied, and having regard to the enormous risks they ran, witness reported to them that to run a single generator for over 2,000 hours involved great risk to the contract, greater than any ordinary contractor would take. Witness advised plaintiffs to come to a settlement with the defendants in the matter. In his opinion it was not business for the plaintiffs to go on running so great a risk in keeping the "slant" unwatered with such a plant.

MR. WILLIAMS: Then, in your view, the contractors were running a great risk themselves?—Undoubtedly, an exceptional risk.

WITNESS admitted that if there was some mistake in connecting the exciter, that might cause some of the trouble complained of in regard to the machine. If the field were improperly connected the machine would be unable to build up sufficient field to give any current. People, however, putting the machine to work originally, would detect this very easily. It was a very easy matter for the erector of the machine to tell whether it was properly connected or not. If there were a cross-connection, the machine would be prevented from exciting at all. Continuing, witness said that some machines would only excite when they had got near their working speed. If the working speed of the exciter in question was normal when the engine was running at 120 R.P.M., it was possible that the machine would not excite if the engine speed were only 110 revolutions. As a rule, when machines were run up to 75 per cent. of their full speed, they would excite. There might be cases where a machine would not excite until it had reached 90 per cent. of its full speed.

COUNSEL: If this machine were one of that kind, would it be a fault in an ordinary man if he ran it and did not discover this difficulty?—WITNESS replied that the man in charge of the machine should run it at its full speed. If that were not done, then it would be neglect on the part of the man. If anything went wrong with an exciter the usual method of endeavouring to ascertain the trouble was first of all to increase the speed of the machine. It was quite possible that a machine, owing to shock in transit, or being knocked about in some way, might entirely lose its residual magnetism, and then when it was put up in the first instance it would be necessary to use a small battery to excite it. Once, however, it had become magnetised, unless the machine stood for a very long period, was subjected to vibration, or was knocked about, it was not very likely that it would lose its magnetism. It was quite possible for a machine to lose it residual magnetism if taken to pieces. After such an operation, the residual magnetism of a machine certainly got weaker, and he thought that in this instance the question of speed of the engine had been overlooked in the endeavour to get the exciter to work after it had been cleaned.

Re-examined, WITNESS said that if the machine were designed to operate in series, and it was coupled up in parallel, all the control would be cut out and a larger volume of current would flow through the coils, with the result that they would get a stronger field. He should expect then that they would get trouble from the overheating of the coils.

This concluded the technical evidence, and the learned Referee heard speeches of counsel.

On Saturday, April 30th, Mr. Pollock, the Official Referee, gave judgment. He reviewed the evidence, &c., of the long hearing at considerable length. Considering, he said, how Mr. Thomas had always urged upon the Electrical Co. the necessity of proceeding with the work without delay, it was a matter of surprise that he took a month to conclude the contract. It was also curious that December 23rd was put forward as the date the plant should be erected. On December 21st, however, defendants wrote to plaintiffs to say that the buildings at the mine were not ready to receive the plant. Therefore, the delay up to that time was obviously due to the defendants, and not to plaintiffs. As regarded the difficulty of the belt, and the point which was raised that it was not included in the contract, he was of opinion that even assuming that the belt was shown on the drawings, that would not help Mr. Thomas's case. This also gave rise to more delay, for which plaintiffs were not responsible. As was usual, during this time defendants were complaining of delay, and the plaintiff company were writing making excuses, because they did not want to offend defendants, but it seemed to him that the plaintiffs had good ground for saying that the delay was not their fault. He found that the contract of 1905 was completed somewhere about the middle of February, 1907, and it was clear upon the evidence that between August, 1906, and June, 1907, some 1,594 tons of coal were got up out of the mine. No doubt difficulties occurred during that time. There were difficulties with the exciter which it was said failed from time to time, but that failure did not interfere with keeping the water out of the mine or with working the coal. In his view the chief difficulty, if not the whole difficulty in regard to the exciter, was due to the improper attention bestowed upon the machine by those in the employ of the defendants. There was obviously no one there who knew anything at all about the electrical plant. There was no expert of any kind there on defendants' behalf, and when an expert went down on plaintiffs' behalf the machine was put in order and worked very well. There was a suggestion that the trouble with the exciter was due to some fault for which the plaintiff company were responsible, but Mr. Sparks and other witnesses called for the plaintiffs showed that the machine ran perfectly well for a certain length of time, and the difficulty could not be due to any inherent defect in the exciter; but, on the other hand, was due to improper attention. He, therefore, came to the conclusion that there was no real material defect in the machine. It was pretty obvious that the steam pipes were responsible for some of the mischief which arose. Mr. H. N. Thomas went so far as to say that he cleaned the exciter 12 times in one day, but he (Mr. Pollock) did not for a moment believe that. As to the flooding of the mine, he did not believe that the accident arose from anything for which the plaintiff company were responsible, and there was no proper evidence upon which he could base such a finding. The drowning of the mine was not the result of any defect in the plaintiffs' machinery. The new agreement after the flooding out of the mine was entered into, and defendants' contention was that this new agreement was a continuation of the agreement made in 1905, and upon this point of view Mr. Thomas had based the counterclaim. He (Mr. Pollock) did not agree with this contention, and, in his opinion, the agreement of June, 1907, was an entirely fresh one. At that time plaintiffs had completed their contract, but the mine was flooded, and it was necessary to take some steps to unwater it. They came to the very simple conclusion that they must start afresh to deal with this uncontemplated state of things, and they showed that they intended to hang up the proceedings, and leave the disputes which had arisen over the 1905 contract to be settled afterwards. The new agreement was consequently entered into, and at this time the plaintiff company were undoubtedly desirous to show that the plant was effective for the purpose of unwatering the mine, because they did not wish it to be said by anyone that their plant could not do the work. This new contract for unwatering the mine, however, had nothing whatever to do with the original contract under which they had only got to supply pumps that would be capable of dealing with the work. The new contract was to get rid of the water in the mine, whatever the amount of it was. In entering into this contract plaintiffs were going to great expense, and were doing so for the benefit of the defendants. They declared that they would get rid of the water, and they ultimately did so, but they did not say they would do so within any specified time. As soon as they started to deal with the matter, Messrs. Thomas began to complain, but Mr. Thomas was in the habit of complaining, and that could not be avoided. The damages defendants claimed were, in his opinion, too remote, and he did not agree that defendants had suffered the enormous amount of damages they claimed, nor could such damages be recovered. The case had lasted 40 days, and was longer than any case he had dealt with before. The time, however, it had occupied was wholly unjustifiable, and had arisen in a great measure from the way in which defendants had brought it forward. They had put forward a counterclaim for £31,000. Most of the time had been occupied in dealing with the counterclaim, and many of the items in that claim had been grossly exaggerated. Concluding, the Learned Referee awarded plaintiffs the sum of £1,105 on the claim and counterclaim, with costs.

Wright *v.* Peters.

In the King's Bench Division last week, Mr. Justice Jelf and a common jury heard this action, in which the plaintiff, an electrical engineer of Queen Victoria Street, sought to recover from Mr. J. Peters, a solicitor, of Birkbeck Bank Chambers, the balance of £97 for work done at the house of the defendant, "Devona," New Southgate.

Mr. Drury was for the plaintiff and Mr. Powell, K.C., for the defendant.

Counsel opened to the effect that in April last the plaintiff got into communication with a limited company called Adinell & Co., who described themselves as electrical engineers, of Snow Hill, and he was asked by them to give an estimate for work to be done at the defendant's house, and for a time he, no doubt, thought he was dealing with the company. He agreed to do the work for £97. The time came when he wanted to be paid some money on account, and on April 22nd he got a letter signed S. G. Adinell, one of the directors, enclosing a cheque for £25, and stating that as they could not get the signatures of the other directors they sent their solicitor's cheque. That cheque was signed McIntire and J. Capel Peters. The defendant thought that extraordinary, but he continued to do the work. He, however, could get no more money, and subsequently discovered that on May 18th a Receiver had been appointed on behalf of the debenture-holders of the company, which seemed to have come to grief. The suspicions of the plaintiff became excited, and he went to Somerset House to find out something about the company. He found that the company had a nominal capital of £1,500 in 1,500 £1 shares, and that 1,000 of them had gone to the promoter. The solicitors to the company were stated to be Messrs. McIntire & Peters, and the latter appeared to be a director and secretary as well. The only other directors were Messrs. Adinell & McIntire. Messrs. Peters & McIntire seemed to have taken charges upon the whole of the company's property, and when the Receiver went in there was only 9d. in cash belonging to the company.

The Plaintiff gave evidence as to the work done by him at the house, part of which, he said, was the installation of a complete unit. He admitted that the transaction was with the company, and said that on learning that the company was in liquidation he introduced himself to Mr. Peters as the person who was supplying the plant at his house at New Southgate.

His Lordship said that the plaintiff clearly had no ground of action against the defendant, as the transaction had been with the limited company. It was not a case for the jury, and judgment must be for the defendant with costs.

Judgment was accordingly entered for the defendant, and an application for stay of execution was refused.

Burnett *v.* Grout.

At the Rotherham County Court last week, George Richardson Burnett, electrical engineer, sued Sydney Walford Grout, electrical engineer, of 39, High Street, for damages for breach of agreement and wages or share of profit, amounting to £33 10s. 4d.

By an agreement of September 23rd, 1909, plaintiff was engaged at the rate of £2 per week, and one-fourth of profits, the business being carried on as the Rotherham Electrical Engineering Co. He was to be employed for two years on these terms, and for three years afterwards, if both parties agreed. On December 18th he received a letter informing him that the defendant was not satisfied with the work the plaintiff had done in Rotherham, and that he (defendant) would not be able to guarantee the payment of his salary; £8 10s. 4d. was said to be due to the plaintiff as one-fourth the profits, and £25 was claimed as damages for breach of the agreement.

Counsel for the defence, said there were no profits but a dead loss of over £28, and the funds of the company were not sufficient to admit of distribution, and the continuance of the payment of the £2 per week to the plaintiff. There was no evidence of wrongful dismissal. What had occurred had been a mutual rescission of a contract.

His Honour gave a verdict for £15.

Glasgow Tramways Valuation Appeal.

At Edinburgh last week, Lord Dundas, as Lord Ordinary on the Bills, heard counsel in the appeal by the Corporation of Glasgow against the valuation for the year ending Whitsunday, 1911, of the lands and heritages forming the undertaking known as the Glasgow Corporation Tramways made by the assessor of railways and canals.

According to the report in the *Glasgow Evening Times*, the yearly rent or value of the undertaking has been fixed by the assessor at £278,070. The Corporation crave that it should be fixed at £230,573. Hitherto the assessor, in making up the valuation (which he does on the revenue principle), has, in applying to the tramway undertaking Sec. 3 of the Valuation of Lands (Scotland) Amendment Act, 1867, allowed as a deduction from the gross revenue not only one-half of the cost of maintenance of the permanent way and electrical equipment of the line, but also one-half of the sum annually set aside for renewal thereof. He now proposed to allow no deduction whatever in respect of such renewal, but to continue to allow one-half of the cost of repairs. As one-half of the sum set aside for renewal amounted last year to over £57,000, the alteration proposed is, in the view of the appellants, a very serious one. The appellants maintain that the position now taken up by the assessor is unjustifiable. In particular, they submit that they are at least entitled to a deduction of one-half of the whole expenses incurred in maintaining or repairing their permanent way and charged to revenue in their published accounts, and that the practice initiated in 1873 should continue to rule. On this basis the valuation for the year ending Whitsunday, 1911, would be £258,838. In the event of its being held that Sec. 3 of the Valuation Act, 1867, does not apply to tramways, the appellants submit that, looking to the nature of the undertaking, the whole expense of maintenance and repair is one which should fall not upon the landlord, but upon the hypothetical tenant, and as such should be a deduction before the valuation is struck. The deduction is in respect of repairs on (1) the causeway, (2) the rails, and (3) the overhead plant, &c. On this basis, the valuation would be £230,573. In the event of a distinction being drawn between the larger and the smaller repairs, the appellants submit that they are entitled to the whole cost of the smaller repairs as a deduction before the valuation is struck, instead of only one-half of such smaller repairs as proposed to be allowed by the assessor. The valuation on this basis would be £269,059.

Lord Dundas reserved judgment.

British Aluminium Co.

In the Companies' Winding-up Court on May 3rd, before Mr. Justice Swinfen Eady, the petition brought by Messrs. Dick, Kerr & Co., Ltd., for the compulsory winding-up of the above company was heard. There was also a petition by A. Schonfield & Co. for a similar order in the list for hearing.

Mr. Martelli, K.C., for the first petitioners, said it was a creditor's petition which had stood over for a long time in order to enable a scheme of reconstruction to be carried out. Such a scheme had now been carried through, and a new company had been incorporated. Part of the provisions of the scheme was that all the creditors were to be paid in full. The petitioners had been paid, and the second petitioners would be paid. Therefore the only order he asked was that there should be no order except that the company should pay the costs. A good many persons gave notice to appear. One of the provisions of the scheme was that "the pending petition for the winding-up of the old company be dismissed, and the costs of the petitioners, and of the company, and of persons properly appearing, be paid by the new company."

Mr. Hamilton, K.C., said he appeared for the creditors who opposed the petition, and he did not ask for any costs.

Counsel, for creditors, in support of the petition, asked for their costs.

His Lordship asked whether the arrangement was that whether the creditors supported or opposed, they were to have one set of costs between them.

Mr. Martelli said he understood that was the arrangement.

Mr. Kirby said he appeared for the company, and his instructions were to consent to the petition being dismissed, with one set of costs for each class of persons appearing and supporting.

Mr. Stewart Smith, K.C., said he appeared for the second petitioners.

His Lordship said all he could do was to dismiss the petition by consent, the respondent company on each petition to pay the costs of the petitioners and one set of costs to contributories; with regard to the creditors, one set of costs to those supporting and one set to those opposing. With regard to the company's costs, he said, he must be silent.

PARLIAMENTARY.

Morecambe Tramways Bill.—This Bill of the Morecambe Tramways Co. came before the Select Committee of the House of Commons, of which Mr. Alfred Emmott is chairman, on Thursday of last week. Mr. Crowthers, the Parliamentary agent for the promoters, said that the Corporation of Morecambe gave notice in 1907 of acquiring the company's system of tramways within their area. Negotiations took place, in which the Board of Trade took a part, with the result that a price was fixed for the purchase of the tramways, and it was paid in July last. The object of the Bill was to enable that money to be divided up amongst the shareholders. The promoters further asked for powers to work their remaining tramways, situated in the adjoining district of Heysham, by mechanical power. Clause 8, which empowered the company on the one hand, and the local authority, companies or bodies authorised to supply electrical power for private or public purposes on the other hand, to enter into an agreement for the supply of electrical energy to the company, had been struck out when the Bill was before the committee of the House of Lords. Mr. Bennett, general manager of the Morecambe Corporation tramways, formally proved the preamble, and the Bill was ordered to proceed.

Havant Gas Bill.—When this measure came before the Unopposed Committee of the House of Lords, Mr. Baker, the Parliamentary agent for the promoters, stated that all the electrical proposals had been struck out.

Bishops Stortford, Harlow and Epping Gas and Electricity Bill.—The consideration of this Bill was resumed before the Unopposed Committee of the House of Commons, presided over by Mr. Emmott, on Thursday of last week. The Clerk of the Bishops Stortford U.D.C., called on behalf of the promoters, said

that that body had passed a resolution at their last meeting confirming the agreement which had been come to between their Parliamentary Committee and the promoters. That compromise had been come to as a result of the promoters putting in a clause in the Bill to the effect that the local authority should have the power of purchase at the end of 21 years, with recurring periods of seven years. Mr. Seager Berry, the Parliamentary agent, stated that the power to manufacture electrical fittings had been struck out of the Bill. The preamble having been proved, the Bill was ordered for third reading.

BUSINESS NOTES.

British Trade with Egypt.—The report of H.M. Agent and Consul-General on the finances, administration and condition of Egypt in 1909 contains an annexe by Mr. Clive on British trade with Egypt in that year. It shows that the share of the United Kingdom in the import trade was 30·3 per cent., as compared with 32·9 per cent. in 1908, and the following items, among others, are given in regard to the value of the imports:—

	Year.	Total imports in 1909.	Share of the United Kingdom.
Steam engines ...	1909	£E.109,138	£E.76,789
" " ...	1908	152,308	98,432
Motor cars	1909	33,503	6,193
" "	1908	49,634	5,820
Electrical machinery	1909	62,949	22,479
" " ...	1908	90,536	36,698
Other machinery ...	1909	168,190	68,287
" " ...	1908	183,692	74,314
Rolling stock ...	1909	14,925	461
" " ...	1908	265,620	218,414

The value of the lamps imported from the United Kingdom increased from £E.4,271 in 1908 to £E.8,390 in 1909, but that of electrical apparatus declined from £E.49,812 to £E.43,415 in the same years respectively.

It is mentioned that a credit of £74,000 has been granted for expenditure in the current year on the improvement of the signalling system on the main railway in Egypt.

Igranic Mining Apparatus.—The Adams Manufacturing Co., of 106, New Bond Street, have recently produced a complete line of mining panels of the flame-proof type. The company realised some time ago that it was well-nigh impossible to make and maintain in use an enclosure for switchgear which would be gas-tight. It was almost certain that the "breathing" effect with a piece of apparatus like a starter would draw gas into the interior of the enclosure. They therefore decided that the best means of tackling the mining switchgear problem would be to make their panels either flame-proof or oil-immersed. The flame-proof type of panel has wide machined joints, to give a large cooling surface for any explosions which might take place in the interior of the case. The cases are strongly built to withstand such internal explosions, and all operating is done from the outside. Their oil-immersed starter is an absolutely original form, and has been specially designed with a view to its application to mines, inasmuch as the parts are arranged for straight-line operation. The starter is of the multiple-switch type, that is to say, each step of resistance is cut out or short-circuited by means of a separate switch; each switch is closed in succession by means of a backward and forward motion of a handle mounted on the top of the case. The first, or bottom, switch is held in by a no-volt release magnet, and is provided with a carbon break and magnetic blow-out. This switch is strongly built, very compact, and is peculiarly suited for oil immersion and use in mines. The switch was illustrated in our issue of April 15th. The company are contemplating having some of their special switchgear, including the apparatus mentioned, on show at their London office, 106, New Bond Street. Other specialities made by the firm are: (1) Automatic starters for both alternating and direct current, for use with air compressors. (2) A new patented capstan controller, whereby the characteristics of the steam-driven capstan are reproduced. (3) Remote-control switches for general use in and about the mine. (4) Specially designed grid resistances in which the grids are specially braced in order that they may stand up to the heavy vibration and rough usage they may be subjected to when installed in a mine. One other point is that all "Igranic" apparatus for use in mines is fitted with mechanical connectors instead of the usual sweating thimbles.

Tantalum Lamps for Ship Lighting.—Messrs. Siemens Bros. Dynamo Works, Ltd., have supplied their tantalum lamps for all classes of ship lighting, from the man-of-war to the ferry boat. They have sent us an illustration showing an Atlantic liner on which over 1,000 tantalum lamps are installed, in comparison with a pleasure motor yacht, the strength of the filament enabling it to withstand the severe vibration experienced under such conditions. Messrs. Siemens Bros. also make a speciality of electric light fittings for ship, yacht and train lighting.

Japanese Trade.—According to the March returns, abstracted in the *Times*, the total exports from Japan during the first three months of this year showed an increase of £1,339,846, and the imports an increase of £935,934.

The Victoria Mining Pump.—A pump embodying several very interesting features has just been ordered by the Lothian Coal Co. for their Whitehill Collieries from Messrs. Jens Orten-Böving, through Messrs. Bruce Peebles, who are supplying the electrical equipment. The pump is of the Victoria type, and is specially designed to deal with a combined duty. The quantity of water to be dealt with is 680 gals. per min. at a depth of 255 ft., and 150 gals. at a depth of 155 ft. By conveying the water from the gallery, at 155 ft., through a pipe to the lower gallery, the duty of the pump is not increased proportionately, that is, though delivering 830 gals. per min. at the bank, the power required is only such as to deliver 680 gals. at a pressure of 255 ft., and 150 gals. at a pressure of 155 ft., the total power being 91 H.P.

If two pumps had been installed, one at each level, the efficiency of the pump at the upper gallery dealing with so small a quantity as 150 gals. per min. would have been very low, whereas by dealing with it through a pump at the lower level, the water from the higher gallery is dealt with by a pump working with the same efficiency as that which would be obtained by a separate pump dealing with these 680 gals. per min. from the bottom gallery.

It will, therefore, be seen that not only is there a reduction in prime cost by installing one pump and one motor, but there is also a considerable saving in working owing to the greatly increased overall efficiency.

Private Meeting.—Bertram Newman, trading as "Newmans," 4, Cranbrook Road, Ilford, electrical and mechanical engineers.—A meeting of the creditors of the above was held on Friday, April 29th, at the offices of Messrs. Poppleton & Appleby, chartered accountants, 4, Charterhouse Square, E.C., when a statement of affairs was presented. According to this the liabilities amounted to £634, while the assets were estimated to realise £570. Mr. Hawkins said that the doubtful book debt was owing by a Mr. Morgan, who would be better known as Southwell Young, a gentleman who was interested in certain skating rinks. The debt arose in respect of work done by the debtor for certain skating rinks, for which Mr. Young had made himself responsible. As security the debtor had certain shares in the Gloucester Skating Rink transferred to him, but apparently those shares had never been allotted. Personally, he did not think the transfer was worth anything, as it was out of order. On the basis of a going concern, the estate showed 20s. in the £. Continuing, Mr. Hawkins stated that the debtor was recommended to consult his firm, and on going into his position they found that one creditor had obtained judgment, and the Sloan Electrical Co. had issued a writ. An execution could have been levied, and in order to protect the assets, the solicitor to one of the suing creditors suggested that if a deed of assignment was executed, he would hold his hand for the time being. Accordingly, a deed of assignment had been executed, but not registered. The debtor traded in the name of "Newmans," and orders had been given on paper headed "Newmans." The debtor's father and brother were also in business at the same address, and, as far as he knew, they also traded in the name of "Newmans," although the various businesses were separate and distinct. The premises were in the name of the father, who sub-let a portion to each of his two sons. The father was an estate agent, while the brother was a decorator. Neither the father nor the brother had ever held himself out as being in any way connected with the electrical business carried on by the debtor. The father was now a creditor on the estate for £83, this claim arising in respect of three debts of the son, which the former had discharged; three creditors were about to put in execution, and were paid out by the father. The debtor started trading for himself in October, 1907, after the completion of his apprenticeship. Last December he took premises at Cranbrook Road, at a rental of £45 per annum, but he ceased to trade there in March of the present year. All moneys received were paid into the bank, and all payments were made out by cheque. The pass-book showed that for the 12 months to December 31st last the receipts were £1,705, while between January and April 24th of the present year they amounted to £450. The debtor estimated that he made a gross profit of 25 per cent., while the expenses, including his drawings of £2 a week, were about £300 per annum. Mr. Kennard (Messrs. Stanley Evans & Co., solicitors) made an offer on behalf of the debtor of a composition of 15s. in the £, payable by instalments at one, three, and six months, and secured to the satisfaction of the three principal creditors. A lengthy discussion ensued, in the course of which numerous questions were asked regarding what connection the debtor's father and brother had with the electrical business. One creditor said he had always assumed he was dealing with "Newmans," and not with the debtor personally. Other creditors said they had always thought that the debtor was merely the manager of the electrical department of the business. Mr. Kennard said that the only way the father and brother could be brought in as partners was if they ever held themselves out as being such. It would not be sufficient if the debtor had stated that he was in partnership with his father and brother. It was denied by the father and brother that there had ever been a partnership. If the creditors were not satisfied with the explanation, the only thing to do was to bring a test action. The debtor was called into the room, and stated that he had always traded alone, and had never told anyone that his father or brother were in partnership with him. He was pressed to increase his offer, and eventually agreed to pay 20s. in the £, by instalments at one, three, six and nine months, and guaranteed to the satisfaction of the principal creditors. No resolution was passed, but it was understood that if the guarantees met with the approval of the principal creditors, the offer would be accepted.

Liquidations.—Davey Electric Co., Ltd.—This company is winding up voluntarily, with Mr. Joseph Andrews, 20, North John Street, Liverpool, as liquidator. A meeting of creditors will be held on May 17th, at 112, Whitechapel, Liverpool. Creditors must send particulars of debts, &c., to the liquidator by June 9th.

The Electric Conversion Syndicate, Ltd.—This company is winding up voluntarily, with Mr. F. S. Salaman, 1, Oxford Court, Cannon Street, E.C., as liquidator. A meeting of creditors will be held on May 9th.

Rubber Exhibition.—It is announced that an International Rubber and Allied Trades Exhibition will be held at the Agricultural Hall, Islington, from June 12th to 28th, 1911.

Port of London Rates.—As the result of the recent inquiry into the rates to be charged by the Port of London Authority, the following are amongst the maximum rates which the Board of Trade have scheduled in a provisional order to be submitted to Parliament:—Electric wires and cables, insulated—rubber-insulated (other than telegraph and telephone cables), 5s. per ton; insulations other than rubber (not being telegraph or telephone cables), 4s.; submarine cables, telegraph and telephone, 3s.; inland cables, telegraph and telephone, 2s.; electrical goods and apparatus not otherwise rated, 2s.; tramway car wheels, 10d.; tanks, core for telegraph cable, 2s.; telegraph or telephone apparatus, or parts thereof, 2s.

Bankruptcy Proceedings.—Wm. Henry Palmer, electrician, 10, Great Castle Street, Oxford Street, W.—A receiving order having been made at the London Bankruptcy Court, the first meeting of creditors was held on Wednesday before Mr. Egerton S. Grey, Official Receiver. It appeared from the debtor's statements that he commenced business alone, but under the style of Palmer & Co., eight years ago, with £400 capital. The trading averaged £2,000 a year, and the business consisted of fitting electric lighting installations in houses and shops. In February, 1909, he assigned the business to Palmer & Co., Electricians, Ltd.; the company took over the benefit of his contracts, trading, goodwill and book debts in consideration of £250, from which a composition of 5s. in the £ was paid to creditors of the business. The claim of the petitioning creditor was in respect of rent of the premises accruing since the assignment to the company. A previous failure in 1881 was recorded against the debtor; those debts were paid in full, and he was released from the proceedings. The present failure was attributed to bad debts and trade losses. In the absence of any offer the case was left in the hands of the Official Receiver to be wound up in bankruptcy, the public examination of the debtor being fixed for May 6th. Messrs. Roberts, Seyd & Co. appeared for the petitioners, and stated that it was believed that the debtor had traded in partnership. They were of opinion that the alleged partner could be held responsible for the present debts, and steps had been taken to bring him before the Court. The chairman remarked that he would cause to be investigated the question of the alleged partnership, and also the circumstances attending the assignment of the business to the company. The debtor roughly estimated his present liability at between £400 and £500, and he had disclosed no assets whatever.

Edmund Meyer Tudor Boddam, engineer and patentee, Howick Place, Victoria Street, S.W.—The first meeting of creditors was held on Tuesday last week at the London Bankruptcy Court before Mr. E. Leadam Hough, senior Official Receiver. It transpired that in 1908 the debtor arranged with a syndicate to form a company to acquire a lift apparatus he had patented. The Hydro-Electric Gear Co., Ltd., was formed, with a nominal capital of £6,000, and as vendor, the debtor received 20,000 1s. shares and £300 in cash. He was appointed engineer to the company, which, however, to all intents and purposes, has ceased to work. The debtor returns his liabilities at £100 17s., and has no assets. He attributes his failure to the costs of an action and to the inability of the company to continue the business. In the absence of any offer, the case was left in the hands of the Official Receiver to be wound up in bankruptcy. The Hyatt Roller Bearing Co., London, are returned as creditors for £32.

John Filmer Davie, electrician, late 10, Great Castle Street, Oxford Street, London, but whose present address the petitioning creditor cannot ascertain.—Receiving order made April 25th. First meeting, May 10th; public examination, June 8th.

William Robert Renshaw, engineer, late general and electrical engineer, Argyle Villa, Newport Road, Stafford, late Phœnix Works, Cliff Vale, Hanley, Staffordshire.—This debtor applied to his Honour Judge Ruegg, at the Town Hall, Hanley, last week for his discharge from bankruptcy. The Official Receiver reported that the receiving order was made on October 29th, 1909, on a creditor's petition. The statement of affairs disclosed liabilities, £18,337, but the proofs actually admitted and the probable claims totalled £18,625. The assets were estimated to realise £1,139, but they had only produced £22, and the probable value of the assets not yet realised was £300, making a total of £322. This considerable difference was accounted for mainly by the debtor having overestimated various securities in the hands of creditors fully secured. No dividend whatever had been paid to the unsecured creditors. For some years before December, 1900, the debtor carried on business in the name of W. R. Renshaw & Co., as a railway carriage and wagon builder and general and electrical engineer at the Phœnix Works, Cliff Vale, Hanley. The concern was turned into a limited liability company in December, 1900, under the style of W. R. Renshaw & Co., Ltd. The debtor's consideration for the sale and purchase was £115,000, to be paid in cash or shares. At the date of the receiving order the debtor held 1,501 fully-paid ordinary shares and 500 fully paid preference shares in the limited company. Since the formation of the company the debtor had given the whole of his time and attention to the company. A Receiver was appointed on behalf of the debenture-holders in March, 1905, and was still in possession. The debtor's salary during the past three years had been £200 a year, and this amount represented his total income. The unsecured liabilities had been mainly incurred for the purpose of assisting the company in the carrying on of its business. After several other matters had been looked into, his Honour adjourned the application to next Court.

Trade Announcements.—Messrs. Davies & Ransome, of Caxton House, Westminster, S.W., have lately been appointed the sole agents in London and the South of England for the Buffoline Noiseless Gear Co., of Levenshulme, Manchester, who are well known for their hide and paper pinions and their metal gearing. The firm has a complete catalogue giving information for finding the most suitable sizes of wheels to transmit any given H.P., and other tables of information for gearing users.

Messrs. Duncan Watson & Co., of Charing Cross Road, are this week moving to their new offices and showrooms, 62, Berners Street, W. Henceforth this will be the firm's only office address, which fact the trade will please take note of.

The D.P. Battery Co., Ltd., have appointed representatives in Argentina and in Turkey. In the first-named country Messrs. Milne, Makein y Cia., of Suiphaca 88, Buenos Ayres, represent them; and the firm of Messrs. Wm. Sprowson & Son, of Constantinople, have accepted their agency for Turkey, Greece and the Balkans.

Catalogues and Lists.—Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London Wall, E.C.—New list No. 62, giving particulars and prices of their twin flexibles (C.M.A. and standard) provided with an earthing core in compliance with the Home Office Regulations.

Messrs. D. H. Bonnella & Son, Ltd., 58-60, Mortimer Street, Cavendish Square, W.—Priced descriptive leaflet relating to the "Ampere" cell. The firm are now the sole agents of the "M.S." metallic-filament lamp.

Messrs. A. & P. Steven, 231-2, Strand, London, W.C.—20-page catalogue containing half-tone illustrations of a number of designs of wrought-iron and wood cars for passenger lifts. Views of the works are also given.

The Sterling Telephone and Electric Co., Ltd., 200, Upper Thames Street, London, E.C.—Publication No. 160, giving illustrations, connection diagrams and prices of their "Sterling" common-battery automatic intercommunication telephones, and particularising the "Invicta" sac battery, multiple telephone cable, &c.

The Edison & Swan United Electric Light Co., Ltd., Queen Street, London, E.C.—Catalogue Section II (fifth edition) containing 22 pages of illustrations, brief descriptions, and prices, of a variety of Ediswan fittings for ship, factory, colliery, street, tramcar, and train lighting.

Messrs. Crompton & Co., Ltd., Salisbury House, London Wall, E.C.—Catalogue U 21, of 48 pages in their standard form and style, dealing very fully with their moving-coil electrical instruments for continuous-current circuits. Details of construction and specimen scales, lists of ranges and code words, and illustrations of numerous patterns of instruments are given.

Messrs. Ferranti, Ltd., Hollinwood, Lancs.—Fourteen-page pamphlet containing descriptions of their two-rate continuous-current meters with excellent half-tone illustrations and diagrams of connections, also a tabulated list of standard sizes.

Messrs. Herbert Morris & Bastert, Ltd., Empress Works, Loughborough.—Publication No. 62 giving pictures, particulars and prices of their pulley blocks, travelling trolleys, overhead travelling cranes, wall cranes, overhead runways, &c.

The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, E.—New 20-page catalogue giving illustrations and prices of various Silvertown mechanical and india-rubber goods, including hose, matting, packing, trolley wheel covering, brake blocks, india-rubber gloves and gauntlets, &c. Copies of the list will be sent to all *bona fide* applicants.

The British Central Electrical Co., 17, Hatton Garden, London, E.C.—Leaflets, priced and illustrated, relating to their "Guardian" shock-proof hand lamps, "Handshield" plugs, watertight fittings, and various other electrical accessories.

Messrs. Cuxon, Gerrard & Co., Ltd., Crown Buildings, Corporation Street, Birmingham.—Pamphlet illustrating their various "Red Cross" "first-aid" cabinets, stretchers, &c., which electricity works ought, perhaps, always to have at hand in the hope that they may never need to use them.

St. Helens Cable and Rubber Co., Ltd., Warrington.—A "Summary Catalogue" has just been issued, consisting of a folding card with an effective frontispiece in colour. The various manufactures coming in the firm's "Rubber" and "Electrical" sections respectively are indicated by a sketch, the purposes for which they are suitable being also stated.

Messrs. Neale & Wilkinson, Ltd., 32, St. Mary Axe, London, E.C.—New A.B.C. tariff of rates for the conveyance of goods and parcels to all parts of the world. The list has been revised and brought up to date, including a number of places abroad recently brought into prominence by the rubber boom. Copies of the handbook can be obtained on application.

Messrs. Jens Orten-Boving & Co., 9½, Union Court, Old Broad Street, London, E.C.—Twenty-eight page catalogue containing full particulars, with excellent half-tone and sectional illustrations, of the Jahns governor operating upon the centrifugal, inertia, and combined centrifugal and inertia principles for engine and turbine regulation. Particulars, code words and prices are tabulated, dimensions also being set out fully.

LIGHTING and POWER NOTES.

Ainsworth.—The Lancashire Electric Power Co. has applied to the B. of T. for permission to use overhead lines for the supply of electricity in the parish of Ainsworth, in the area of the Bury R.D.C.

Ballyclare (Co. Antrim).—At the monthly meeting of the U.D.C. on Monday last a communication was received from the Board of Works refusing to reconsider the electric lighting scheme for the town and immediate locality.

Bexley Heath.—The U.D.C. has reduced the charges for energy for power to large consumers as under: Over 10,000 units and under 20,000, 1¾d. per unit; 20,000 and under 40,000, 1½d.; beyond, 1¼d., with a minimum charge of £2 13s. 4d. per annum, independent of the meter.

Bridlington.—The L.G.B. has informed the T.C. that if the proposed extensions at the electricity works, for which a loan of £3,000 has been applied for, are proceeded with at once, it will incur the risk of having to defray the cost out of current revenue, should the Board for any reason be unwilling to sanction a loan. The Council has replied that it is absolutely necessary to incur the risk, as otherwise it will be impossible to supply the demand during the ensuing season.

Brighton.—The T.C. has been recommended to thoroughly overhaul the electrical installation at the Pavilion, the older portions of which are in a most unsatisfactory condition. The estimated cost of the work is £500.

Burton-on-Trent.—The annual report of Mr. P. J. Pringle, the borough electrical engineer, discloses a very satisfactory situation, inasmuch as the surplus amounted to £1,474, all of which was allocated to writing down capital and renewals. This result has been obtained despite bad trade and the temporary effect of economical lamps. Actually the revenue shows a small decrease compared with the previous year, but owing to energetic measures in the boiler house, fuel expenses were reduced from £2,335 to £1,691, thus showing a saving on fuel alone of £644, and giving the very creditable coal cost of ·284d. per unit; and with other economies, works costs of ·712d. per unit, and total costs of ·918d. It will be remembered that Mr. Pringle's efforts in the direction of boiler house economics were outlined in an article by him, on "Heat Transmission and Fuel Economy," in our issue of January 14th last, the results here given being a continuance of those mentioned in his article.

Another item almost peculiar to the Burton undertaking, is the successful adoption of the restricted-hour system of motor supply. Out of a total of 933 H.P. in motors connected, 744 H.P. is supplied on the restricted-hour system; of a further 118 H.P. shortly to be connected, 80 H.P. will be on the restricted-hour system; moreover, 79 per cent. of the motor units were taken by restricted-hour motors, the average revenue amounting to ·85d. per unit. The total output of the station sold was 1,529,600 units, including 560,604 motor units, and 667,032 traction units; maximum load, 875 KW.; combined load factor, 19·95; and the surplus of £1,474 mentioned, is exclusive of a further £191 tax rebate, which has also been added to the renewals fund.

Canada.—The Ottawa and Montreal Power and Transmission Co.'s Bill is meeting with considerable opposition in the House of Commons. The company, which is composed of Ottawa capitalists who own most of the existing hydro-electric plants around Ottawa, proposes to build a transmission line from Ottawa to Montreal, and asks expropriation privileges for the line.

Strong pressure has been brought by Niagara power interests upon the Dominion Government to veto the Ontario Hydro-Electric Transmission Bill; but the Federal Government (which under the British North American Act has the power of vetoing any provincial Bills considered *ultra vires*) refuses to exercise its power in regard to this Bill. It, therefore, stands as the law of the land for all time.

Bonds to the value of $3,000,000 have been issued to defray the cost of the hydro-electric transmission line from Toronto to Niagara. This line is not a direct one, but is intended to take in the various important towns *en route*.

Cheltenham.—A L.G.B. inquiry was held on April 28th into the application of the T.C. for a loan of £4,000 for electricity purposes, £1,000 being for meters, £1,000 for services and £2,000 for mains extensions. At the suggestion of the Inspector (Mr. H. R. Hooper), it was decided to reduce the loan for meters to £500 and to increase that for services to £1,500. There was no objection.

China.—In the course of his report on the trade of Changsha, Mr. Acting-Consul Hewlett says that a Chinese electric light company was formed during the year, and it is stated that Changsha will be lighted with electric light during this year. The contract was given to a German firm. Mr. H. H. Fox, the British Consul at Wahu, reports that the Wahu Electric Light Co., which is Chinese-owned and under Chinese management, commenced operations in May, 1909, and now maintains a regular supply to some 4,000 lights in the native city. Additional machinery has lately been imported with a view to increasing the power, so that a day and night supply can be assured, and a scheme is on foot to make use of electric current as the driving power of the rice-cleaning machinery in one of the local mills.

Clyde Valley.—As a vessel was proceeding up the river on Thursday last, she dropped her anchor to prevent drifting towards the north bank. This occurred at a spot immediately opposite the generating station of the Clyde Valley Electrical Power Co., and the anchor came in contact with the cables crossing from the station to the opposite bank. The cables were carrying a pressure of 11,000 volts at the time; luckily, however, they are heavily armoured, and the damage was not serious enough to interfere with the supply of current. It has been arranged that the Yoker power house will take charge of the supply in the meantime, on that side of the river, and all the Renfrew supply on the other side will be received from the Motherwell station. But for the company's system permitting of this being done, the accident might have had serious results.

Continental Notes.—HUNGARY.—The authorities of the Hungarian State coal mines have just placed a contract with Messrs. Ganz & Co., of Buda Pesth, for the establishment of electric generating plant at the collieries at Petrosseny, at Brdnik. The first-named plant will comprise eight Babcock-Wilcox boilers, two Zoelly steam turbines of 3,700 H.P., and three-phase alternating plant. At the Brdnik collieries a couple of 1,000-H.P. steam turbines of the same type, three-phase plant, &c., and three water-tube boilers are to be installed.

The Mátyásföld Landlords' Association has decided to equip the town with waterworks and electric light, at an estimated cost of £11,700.—*Board of Trade Journal.*

ITALY.—La Société General Electrique del Adamello has completed its central generating station at Poglia, and the high-tension distribution is now in operation as far as Monza. Work is in hand on the establishment of a second plant, and it has also been decided to install plant to utilise the water power of Lake Arno; to enable this to be carried out, it has been decided to increase the capital of the concern to the extent of £100,000.

NORWAY.—Plans have been drawn up for the erection of hydro-electric works at Numedalslaagen, where the State possesses water-power rated at 164,000 H.P.; the cost is estimated at over a million pounds sterling, or about £9 per KW.

Darwen.—Last year there was a profit of £573 on the electricity undertaking, but official figures are not yet known concerning the loss on the electric tramways. The reduced charge to the tramways has accounted for a reduction in receipts to the electricity department of nearly £400 compared with the previous year.

Derby.—The B. of T. has granted the T.C. a prov. order for extending the area of supply.

The mains are to be extended to the premises of Messrs. W. Rickard, Ltd., Ashbourne Road, at a cost of £800, and to other premises at a cost of £140.

Dundalk.—The U.D.C. has applied to the B. of T. for its consent to the placing of overhead electric wires in the streets and roads in which it is proposed to have the contemplated electric lighting, for the execution of which a loan has been applied for.

Dundee.—A proposal to reduce the charge for electrical supply to the tramways from 1½d. per unit to 1d. per unit was considered last week at a conference of the Electricity and Tramway Committees of the T.C. The electrical engineer (Mr. H. Richardson) in his report stated that several causes combined to effect a reduction in the tramway revenue of his department, the reduction this year being £600, and probably next year it would increase to £1,000. The department was also, in his opinion, to feel for some time the reduction in revenue due to the economy of the new metallic-filament lamps. As the reduction of ¼d. per unit would mean a corresponding revenue of £1,300 per annum he could not recommend the proposal. The tramways convener in the subsequent discussion said that he thought the tramways were being exploited to give cheaper electricity to other people, and complained that all the customers of the electricity department, with the exception of the tramways, had benefited within recent years. Eventually a compromise was obtained, it being agreed to place a flat rate for lighting and power supplied to the tramways.

Saturday evening last saw the inauguration of electric lighting in the High Street and Bank Street, Lochee, the lamps being of the Duplex Excello type and 16 in number. Lochee, a busy town in itself, adjoins Dundee, being about two miles distant and linked up with a service of cars. It has hitherto been quite a common thing to hear the place referred to as "Lochee and nae licht," but as Convener Don very pithily remarked, the conditions were now just reversed.

Eccles.—The electrical engineer is to offer to supply current to the Crown Theatre at 2½d. per unit, subject to an undertaking being entered into that the supply shall not exceed at any time 25 KW., and that there be a guaranteed minimum yearly consumption of 25,000 units. Tenders are to be invited for an additional 10-in. motor-driven centrifugal pump and switchgear; also for a high-tension feeder.

Glasgow.—The trustees of the Clyde Navigation have decided that the electric crane equipment on the south quay wall of the Rothesay Dock shall be augmented by three new cranes, and the work will be done at the Renfrew workshops of the Trust.

Grangemouth.—The T.C. has adopted a scheme of street lighting with some 45 tungsten lamps of 50 and 100-C.P. each. It was also agreed that the cables should be laid underground, and this decision was communicated to the Scottish Central Electric Power

Co. At a later meeting Mr. Churchward, on behalf of the company, accepted the proposal that the cables should be laid underground for street lighting, but he strenuously objected to high-tension cables being laid underground. It was agreed to allow overhead wires for this part of the system, provided they were according to the B. of T. regulations.

Leicester.—At a meeting of the T.C. on Tuesday last week, Ald. Flint moved the adoption of the report of the Tramways Committee recommending the installation of additional generating plant at the tramways generating station and the extension of the buildings to accommodate such plant, at a cost of £19,190. Ald. Flint said that, acting under the authority of the Council, the Tramways Committee had been supplying electrical energy for the last 18 months or more for power purposes to various firms in the town. At the end of December, 1908, the Committee was supplying 225 H.P.; in June, 1909, it was 468 H.P.; at the end of December, 1909, it was 669 H.P.; and on the 25th of the present month it was over 1,200 H.P. A 1,000-H.P. turbine was proposed to be driven by the exhaust steam from an existing 1,500-H.P. engine, and also arranged so as to be driven independently by live steam. The estimated cost of the proposed additions was: Engine and equipment, £10,490; extension of buildings, £8,700—total, £19,190. Ald. Smith seconded, and the report was approved. The recommendation of the Committee to reduce the basic charge for the supply of power from 15s. a quarter per H.P. to 10s. per quarter was agreed to. The reduced charge, it was stated, would still leave the Committee a very large margin of profit.

Leyton.—The surveyor has been instructed to prepare a plan and estimate for the lighting of the remainder of Lea Bridge Road with arc lamps. He is also to prepare alternative reports and estimates for the carrying-out of the lighting by clusters of incandescent lamps. The surveyor is further to prepare a plan showing the positions in which arc lamps should be placed in all the main roads and Whipps Cross Road to light the same efficiently.

London.—SOUTHWARK.—The Electric Light Committee reports that it has had under consideration a communication from the electrical engineer and manager upon the question of the extension of the plant at the generating station, which he estimates to cost £6,909. In submitting his scheme the engineer points out that the installing of the condensing plant proposed will be the means of effecting very great economy in the generating cost. In conjunction with the condensing plant, the engineer also states that it will be advisable to install an additional generating set to utilise the exhaust steam which is now being wasted. The conclusions arrived at by the Committee on the consideration of the engineer's reports may be summarised as follows:—That the installing of a turbine set, condensing plant, and cooling tower would be the means of (*a*) preventing the exhaust steam being wasted in considerable quantities; (*b*) utilising it in such a manner that it would be sufficient to generate additional units to the extent of 750,000 per annum, without increased cost of coal, water or wages; (*c*) augmenting the plant installed from 1,200 to 1,800 KW., sufficient to take the additional load (under normal conditions) likely to come on for several years; (*d*) reducing the coal consumption, which is now 7 lb. per unit (non-condensing) sold, including stand-by loss, by 40 per cent., or, in other words, increasing the units sold to about 2,250,000 without extra cost; and (*e*) effecting a net saving of £534 per annum. The Committee had visited the Grove Road power station, Regent's Park, and inspec ed the turbines, &c., in operation there, and the records and charts prove that since the partial conversion to turbines the total costs have been reduced from approximately 1d. to under ½d. per unit, or, in actual figures, from ·97 to ·44, a relative saving of 44 per cent. The expenditure, estimated at £6,909, is proposed to be raised by loan for a period of 20 years. About half the above expenditure will be incurred in making the existing plant more economical, the remainder in increasing the capacity of the generating plant. Under average conditions the reduction in fuel consumption can safely be taken at not less than 25 per cent., equal to £1,000 per annum, out of which the sinking-fund charges and interest on both condensing and generating plant would have to be met, making the net result £534. The Committee has decided (subject to the usual sanction) that the necessary extension of plant be carried out at a total estimated cost of £6,909 made up as follows:—600-KW. turbo-generator, £3,300; foundation, &c., £180; switchgear, £300; condensing plant, £1,800; cooling tower, £1,000; contingencies, £329.

STEPNEY.—The Electricity Committee reports having been approached by large firms who require a supply for both lighting and power purposes (one is at present generating its own supply), and who desire that there should be formulated a combined rate to cover both a lighting and a power load. The Committee had decided (subject to the usual sanction) to meet the request which had been made. What was proposed would slightly reduce the present accounts of two existing power users, but would undoubtedly result in increasing the Council's output. The engineer and manager informed the Committee that another important point in connection with large supplies was that a fixed rate was frequently asked for; the Committee recommends that to power users who are willing to guarantee a minimum half-yearly bill of £200 the rate be £3 per annum per E.H.P. demanded, divided into 12 monthly payments (based upon the monthly demand), and ½d. per unit for electricity consumed, whether for lighting or power purposes, provided that the total lighting demand in E.H.P. does not exceed 25 per cent.; also that the Committee be empowered to charge fixed rates calculated on the above-mentioned scale when the load act or is guaranteed.

WESTMINSTER.—At the meeting of the City Council on April 28th, the Works Committee again reported on the street lighting scheme brought forward at the previous meeting, for which the tender of the Gas Light and Coke Co. was accepted, for five years. The Committee further reported that all particulars had been given to the tradesmen in Regent Street and Piccadilly, who had petitioned for the present system of electric lighting to be continued in their district. An amendment was moved to the report suggesting that the petitioners' wishes should be carried out, but this was withdrawn on Councillor Abady (chairman of the Committee) again explaining the whole circumstances. He pointed out that the electric light company had sent a letter to members of the Council stating that the form of tender was unfair to the company, as it did not give it an opportunity to tender solely for the district in which its electrical mains and plant were already established, and it had had to throw on to this district the whole cost of any installations it might be required to make elsewhere if its tender were accepted. The Councillor denied that the form of tender was so drawn, and said the company could have quoted a special price for a particular district, if it had thought of it. The Committee's report was adopted without further opposition.

The contracts for the supply of electricity to the Council's buildings expire on June 24th. The town clerk has been instructed to negotiate for the renewal of the contracts on the same terms as at present, viz.:—Metropolitan Electric Supply Co., Ltd. 2½d. per unit for lighting; St. James' and Pall Mall Electric Light Co. and the Charing Cross, West End and City Electricity Supply Co., Ltd., 2d. per unit for power.

PADDINGTON.—With a view to solving the ever-pressing street lighting problem, the Metropolitan E.S. Co. has recently installed two 400-C.P. Osram lamps on an arc lamp-post in Westbourne Terrace, as an experiment. Specially designed brackets and globes have been used, and a very satisfactory lighting effect is obtained. The company is also trying 100-C.P. Osram lamps in special globes, on ordinary street gas pillars.

POPLAR.—The following alterations are to be carried out: main station—re-arrangement of feeder panels, dispensing with rubber cables and connections where possible, £120; dispensing with rubber cables from two engines, £45; moving existing L.T. panel and connecting to main switchboard in accordance with regulations, £297; Millwall sub-station—guards and handrails to motor converters, £20; Northern sub-station—dismantling and re-erecting motor-converter, £72; Glangall Road sub-station—alterations to cable supports and modification to L.T. switchboard and platform, £154.

Pendlebury.—It will be regarded as a matter of importance among the cotton spinners of Lancashire that a new contract for electrical power and lighting supply has this week been concluded between the Acme Mill Spinning Co. at Pendlebury and the Lancashire Electric Power Co. The contract will commence on May 1st, and is to include a portion of the Albion Mill, which adjoins the Acme; it is for a long term of years.

Ripon.—The T.C. proposes to install a system of electrical appliances at the Spa baths, at an estimated cost of £200. Electricity will be obtained from the Spa Hydro Hotel, and eight electrical treatments will be provided.

Southampton.—The E.L. Committee has agreed to the engineer's recommendation to split up the Portswood H.T. trunk main, at a cost of £272 for cable and £90 for spare ducts.

Stockton Heath.—The Warrington T.C. has objected to the application of the Salt Union for a prov. order for E.L. at Stockton Heath, on the ground that as it supplied energy for the tramways there it should be empowered to supply energy for lighting, which it could do more effectively than any concern with works at Runcorn. The Parish Council has also objected to the application in view of the granting of urban powers.

Todmorden.—The electricity department of the Corporation shows a loss for the past year of £390, as compared with £461 in the previous year. The number of units sold during the year was 119 649, against 106,918 in the preceding year, an increase of 12 per cent.

Wednesbury.—The annual report of the Corporation's electricity undertaking shows that the number of units sold for lighting purposes was 162,083, compared with 109,066, an increase of 53,017; whilst the quantity sold for power was 271,184, against 114,642, an increase of 156,542, the total increase being 209,559 units. The output has been nearly doubled, and the increased sales for lighting are stated to be particularly gratifying. As to the financial results, the sales of electricity (less bad debts) amounted to £3,016, the generating expenses were £1,028 and the distributing expenses £83. The gross profit on the trading was £1,485, and the net surplus on the year's working, after meeting interest and repayment on loan account, £142. The Committee claims that the result marks an epoch in the history of the undertaking, which, it states, is now self-supporting.

West Bromwich.—The Corporation Electricity Committee, in its annual report, states that the sales of energy for the year ending March 31st were: Private lighting, £3,661—increase, £287; public lighting, £690—increase, £15; tramway traction power, £5,317—decrease, £1,282; motive power, £3,443—increase, £632. The total shows a net decrease of £348, which is 2·59 per cent. below the previous year. The Committee, in consequence of the steady increase in the demand for electrical energy for lighting and power purposes, proposes to lay a new main from the works to Spon Lane district and to install a new turbo-generator at the electricity works.

Wigan.—The T.C. has received a letter from the L.G.B. stating, with reference to an application of the Corporation for sanction to borrow £36,000 for the electricity undertaking, that the Board will not raise any objection to the Council commencing the works at once.

TRAMWAY and RAILWAY NOTES.

Argentine.—As was reported a few months ago, schemes have been sanctioned for the construction of underground electric railways at Buenos Ayres, the concessions having been secured by, or with the co-operation of, the Anglo-Argentine Tramways Co. and the Compagnie Générale de Tramways de Buenos Ayres, of Brussels, in the latter of which German capital is interested. The latter fact is recalled by the circumstance that the question of the financing of the underground railways in question was raised at the recent general meeting of the Berlin Electrical Undertakings Co. It was stated that the amount of capital required for the purpose by the Anglo-Argentine Co., which was referred to as a subsidiary of the Belgian Compagnie Générale de Tramways, would range from £4,000,000 to £5,000,000, and that the sum would be raised only in the English market by the issue of debentures, which, it was submitted, would be readily subscribed. As so much information appears to be available on the subject in electrical circles in Berlin, it would be of interest to learn whether anything is also known there respecting the proposed allocation of contracts for the construction of the tunnels and equipment of the lines. The matter is of importance, from the fact that German electrical interests are very strongly represented in Buenos Ayres at the present time, but if the English market is to be asked to absorb several millions sterling in debentures, English firms should be entitled to the contracts for the proposed railways. It cannot, of course, be definitely stated that the contracts will not be awarded to British firms, although the circumstance that the problem of floating the capital was mentioned at the Berlin meeting indicates the necessity for the matter to be closely followed in this country.

Audenshaw.—The U.D.C. has leased the tramways to Manchester T.C. for a period ending on April 1st, 1924.

Australia.—An agitation is on foot for the immediate termination of the lease of the Melbourne and suburban tramways, which has another six years to run. The Tramway Trust (consisting of 10 City Council members and 17 suburban Council members) constructed the lines and leased them to an operating company. The system consists of 43¼ miles of cable and 3¾ miles of horse route. The City Council and outlying municipalities have now taken the matter up. The Minister of Railways recommends that the Government should take over the tramways and convert them to electrical working. It may be mentioned that the agitation arose from the poor service given on the horse-car routes.

Bolton.—The completion of the Darcy Lever tramway having been reported to the Tramway Committee by the borough engineer (Mr. E. L. Morgan), application is to be made to the B. of T. for an inspection of the following tramways, the construction of which was authorised by the Bolton Corporation Order, 1909:—Darcy Lever, Thynne Street, Lower Bridgman Street, and junction with the last-named tramway.

Belfast.—At the quarterly meeting of the Council, various extensions of the existing tramway system were spoken of, including the talked-of branch to M'Art's Fort on the top of the Cave Hill, the big mountain which looms over the city, and the extensions on the Donegall Road and through Ligoneil village.

As a result of the plebiscite taken last week, the ratepayers of the city have confirmed the resolution of the Corporation to purchase the Cavehill and Whitewell Tramway Co.'s system at a figure to be decided upon by the arbitrators of the B. of T. The resolution had an overwhelming majority of over 18,000.

Bournemouth.—Mr. C. W. Hill, the manager of the Corporation Tramways, has presented a report recommending the discontinuance of the conduit system and the substitution for it of the overhead system, which he states will save £3,000 a year. This report will be considered at the next meeting of the Tramways Committee.

Burnley.—The T.C. has been recommended to sanction the extension of the electrical tramways up Briercliffe Road, a distance of 1,382 yd., along Rosegrove Lane, a further 330 yd., and to the boundary at Manchester Road, an extra 262 yd.

Canada.—Plans of the Montreal Street Railway Co., providing for three distinct underground lines and one junction subway route in Montreal, have been submitted to the Quebec Legislation. The street railway officials state that the St James tunnel, the most important, will be started at once, after that the St. Denis Street subway is regarded as most needed, and following that, St. Catherine Street. The underground and elevated company plans have also been completed. They provide for a line from Montreal, some miles out of the city. The line will be elevated outside the city limits and underground inside.

Huddersfield.—The Borough Treasurer's financial statement of the Corporation tramways for the year ended March 31st, shows a capital outlay to date of £408,326. The number of miles run was 2,027,077 compared with 1,998,185 in the previous year. The income amounted to £90,829, or 10·75d. per car-mile, against £84,357 and 10·13d. in the previous year. The total working expenditure was £47,467, or 5·62d. per car-mile, compared with £45,745 or 5·49d. per car-mile. Rent of leased lines (Linthwaite) absorbed £1,206, interest on capital, £13,012 and redemption of debt, £10,087, a total of £24,305, or 2·88d. per car mile, compared with £24,164 and 2·90d., leaving a surplus of £19,057 or 2·25d. per car-mile, compared with £14,448 and 1·74d. After providing for depreciation at 3 per cent. (£12,250) there is a net surplus of £6,807 which has been transferred in relief of the borough rate.

The Conciliation Board has met and all the members voted for the following resolution relating to the tramwaymen's holidays:—"That the present arrangement of four days' holiday, with pay, be continued for this year, and that after this year, holidays be allowed, as follows:—After one year's service, three days; after two years' service, four days; after three years' service, five days; after four years' service and over, six days, subject to the men working an Christmas days with double pay."

The Linthwaite U.D.C. having failed to commence the work of relaying the track (which is leased to the Corporation), and which, in accordance with the award of a B. of T. arbitrator should have been completed by May 1st, the Tramways Committee has decided that on and after May 2nd, the minimum service under the agreement between the Corporation and the Council of one car per hour, be run to and from the borough boundary. The Corporation has given the Committee full power to deal with the question. Terms for the taking over of the tramway by the Corporation have been discussed, but the price required by the Council was unsatisfactory.

Japan.—The Odawara Electric Railway Co. intends to extend the Kozu-Yumoto line, at an estimate cost of £450,000.

Nelson.—Mr. Helme, the electrical engineer, in his annual report announces a loss of £132 against an estimated profit of £263, although there was a decreased expenditure of £102. This is due to negotiations not having been completed with the Burnley Corporation for the supply of electricity to its tramways department, and, pending a settlement, only a payment on account has been made for the energy supplied. The sale of current for lighting purposes has realised more than was anticipated, but had the various new places of entertainment not taken their supply from the mains, the revenue from this source would have been less than last year. This is due to the general adoption of metallic-filament lamps.

The Corporation electric tramways show a loss on the year's working of £771. Although this is less than was anticipated it is by no means a satisfactory result, says the manager, Mr. Helme. The receipts were not up to the average during the summer. The receipts per car-mile were 8·56d. The light railways have been working for seven years, and the manager is of the opinion that until the half-penny fare system is abolished, the undertaking will not be successful financially.

Newcastle-on-Tyne.—A Special Sub-Committee of the Corporation Tramways Committee has been appointed to take into consideration the possibility of seeking powers to run trackless trolley cars to some of the outlying districts of the city, such as Newburn, and other places such as are wishful of being linked with Newcastle. The Committee will also consider the further extension of lines in Heaton.

Perth.—The T.C. has agreed to extend the Craigie section of the Corporation tramways, and to double the line in part of High Street at a cost of £613; against the latter part of the resolution a number of shopkeepers are up in arms, on the ground that the street is too narrow for a double track, and that their business is likely to be interfered with.

Potteries.—The Federated Council has decided to oppose the application of the Potteries Electric Traction Co., Ltd., for the abandonment of certain authorised light railways in Hanley and Longton.

TELEGRAPH and TELEPHONE NOTES.

Canadian Deferred Telegrams.—On account of the success of the system in the United States, the Great North-Western and Canadian Pacific Telegraph Companies have applied the service to all parts of Canada. The two companies will now accept night letters for transmission to any of their connections in Canada or the United States for delivery the following morning. A night letter of 50 words or less can be sent at the rate regularly charged for a 10-word message, with a charge of one-fifth the day rates for each additional two words.

Cuba.—A question has been raised as to the validity of a concession granted by the President of the Republic of Cuba to the Cuban Telephone Co. last year. The matter will have to be decided by the Supreme Court of Cuba.

New Channel Cable.—On Wednesday, the laying of the new telephone cable from Abbot's Cliff, near Dover, to Cape Grisnez was commenced by the Government c.s. *Monarch*, which was to continue the work yesterday in conjunction with the *Faraday*. There will be two cables, each equipped with loading coils at intervals of 1 mile.

Newfoundland Telegraph Dispute. — Before the Judicial Committee of the Privy Council last week, an appeal was heard from a decision of the Supreme Court of Newfoundland of May 1st, 1909, according to which, at the instance of the Anglo-American Telegraph Co, the Reid-Newfoundland Co. was ordered to remove a telegraph line which it had erected along a section of railway from St. John's to Whitbourne, Newfoundland. Their Lordships reserved judgment.

New Zealand.—The Government proposes to establish two high-power wireless stations, one in each island, and a low-power system for coastal purposes.

Wireless Telegraphy.—It is reported that Captain Hovland, of the Norwegian Marine, has recently demonstrated before the Union of Engineers and Architects an invention, with the aid of which it is possible to transmit secret wireless messages, which can only reach those for whom they are intended, and which cannot possibly be tapped by any outside person. A company has been formed to exploit the invention on a commercial basis.

A wireless system is projected, to connect all parts of French West Africa with Algeria.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Queensland.—June 8th. Six sections of common-battery switchboard and equipment, jumper wire, and cable, for the P.M.G.'s Dept. Tender forms, &c., at the Commonwealth Office, London, S.W. See "Official Notices" April 1st.

June 8th.—Protectors, small switchboards, and common-battery telephones, for the P.M.G.'s Department. See "Official Notices" April 15th.

New South Wales.—June 1st. Eight sections of common-battery switchboard, for the P.M.G.'s Department. See "Official Notices" April 15th.

Two tons of wire, twisted pair, outside distributing, No. 16 S.W.G., for the P.M.G.'s Department. See "Official Notices" April 29th.

June 7th.—One main distributing frame, for the P.M.G.'s Department in Western Australia. See "Official Notices" April 29th.

June 14th.—100 party-line common-battery telephone wall sets; 10 party-line common-battery table sets; 100 switches, common-battery, single extension and intercommunication; and 3,000 telephone protectors, for the P.M.G.'s Department in Victoria. See "Official Notices" April 29th.

Austria.—May 12th. The Royal and Imperial Salt Works at Ebensee, invite tenders for the supply and installation of electrically-worked machinery and appliances for the transport and handling of salt, shunting of railway wagons, &c. Particulars from, and offers to, Herr Wasoner, K.K., Salinen-Verwaltung, Ebensee.

Beckenham.—May 23rd. Wiring of houses, for the U.D.C. See "Official Notices" to-day.

Belfast.—May 23rd. Motor boosters and switchgear, and extension of lighting switchboard, for the Corporation. See "Official Notices" to-day.

Belgium.—June 15th. Tenders are being invited by the Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science), for the contract for the electrification of the railway between Brussels and Haecht. The contract includes the overhead equipment, the sub-station, and the fitting of the rolling-stock.

Canada.—Winnipeg.—May 16th. Conduit, sub-station transformers and switching apparatus for the Board of Control. Specifications can be seen at Board of Trade Commercial Intelligence Department in London.

Croydon.—May 26th. Electric lighting at the Borough Hospital, Waddon. See "Official Notices" to-day.

Darlington.—May 25th. Condensing plant for the Corporation Electricity Committee. See "Official Notices" to-day.

Dublin.—May 20th. Flame arc lamps and pillars, for the Corporation. See "Official Notices" to-day.

Germany.—The municipal authorities of Coblenz are about to invite tenders for the establishment of a central electric lighting station in the town.

Halifax.—May 14th. Electrical work at new police buildings, for the T.C.; James Lord, Borough Engineer, Hall (returnable deposit, £5).

Heston and Isleworth.—May 11th. Extension of the engine room; 250-kw. generating set, boiler feed pump, ejector condenser, piping and connections, machine tools, &c., for the U.D.C. See "Official Notices" April 22nd.

Leeds.—May 9th. 5¼ miles of ·15 sq. in. extra-high-tension three-core cable, for the City Electricity Department. See Official Notices" April 22nd.

Leicester.—May 25th. Mixed-pressure steam turbine, direct coupled to 750-kw. d.c. generator, together with condensing plant, switchboard, &c., and two Lancashire boilers, together with fuel economiser, pipes, &c., for the Corporation Tramways Committee. See "Official Notices" to-day.

London.—May 11th. Stores, for the Metropolitan Asylums Board. See "Official Notices" to-day.

St. Pancras.—May 23rd. Twenty-one flame arc lamps, with 20 cradles, for the B.C. See "Official Notices" to-day.

Radcliffe.—May 14th. One 300-kw. continuous-current dynamo, for the U.D.C. Electricity Department. See "Official Notices" April 29th.

Spain.—May 14th. The municipal authorities of Salamanca are inviting tenders for the concession for the electric lighting of the town.

Tasmania.—Launceston.—June 13th: Overhead electric equipment of tramways for municipal authorities. June 27th: Synchronous motor-generators and battery, reversible booster, &c. Tenders in both cases to Mayor and Aldermen, Town Hall. Conditions, &c., from Town Clerk (one guinea deposit each specification).

Turkey.—May 28th. H.M. Consul at Constantinople (Mr. A. T. Waugh) reports that tenders are invited by the Turkish Ministry of Commerce and Public Works for a concession for the supply to the city of Constantinople of electrical energy. See this column of our issue of April 15th, for fuller particulars.

Uruguay.—July 4th. Twenty electric cranes, 1·5 to 5 tons, for the port of Monte Video. Particulars from the Administrative Council of the Port.

Wallasey.—May 30th. Alternating-current transformers, for the U.D.C. Electricity Department. See "Official Notices" to-day.

CLOSED.

Bolton.—The Electricity Committee has accepted the tender of Messrs. E. Bennis & Co., for mechanical stokers for the Electricity Works.

Eccles.—The T.C. has accepted the tender of Bertram Thomas (Manchester) for the extension of a traction switchboard for £48 10s.

Glasgow.—The Clyde Navigation Trustees have accepted the following:—

Transformer house at Yorkhill for electric current for capstans.—Messrs. Wm. Shaw & Sons, Ltd., £897.
Cables for Yorkhill.—Messrs. Gilchrist & Brown, Ltd., £950.
Switches and fuses for capstans, being made at the Renfrew workshops of the Trust for Yorkhill and Springfield.—Messrs. Dorman & Smith, £59, and for switchboards, Messrs. Dorman & Smith, £100.
Cables for capstans at Springfield Quay.—Messrs. Johnson & Phillips, Ltd., £115.

Gloucester.—The T.C. has accepted the tender of Messrs. W. M. Geipel & Co., for arc lamp carbons, at £112.

Huddersfield.—The T.C. has accepted the tender of Messrs. J. Marsden & Son, Huddersfield, for installing the E.L. at the Birkby Schools, at £119.

London.—L.C.C.—For the supply of three-phase motors for the second section of the central car-repair depot, the Highways Committee received tenders as follows:—

Bruce Peebles	(recommended)	£575
Lancashire Dynamo and Motor Co.		611
Electric Construction Co.		624
British Westinghouse Electric		678
British Thomson-Houston		741
Dick, Kerr	(incomplete tender)	849

Chief officer's estimate, £700.

It is proposed to wire several underground conveniences, now lighted by gas, for electric lighting. The saving per annum is estimated at £13. The wiring tenders were:—

Sweet Bros.	(recommended)	£55
Barlow Bros.		67
Ward Bros.		76

St. Pancras.—The T.C. has received the following tenders for the annual supplies of arc lamp carbons:—

Sloan Electrical Co.	(accepted)	£688
William Geipel & Co.		744
H. G. Mayer & Co.		756
Crompton & Co., Ltd.		764
Ship Carbons, Ltd.		774
G. Braulik		814
General Electric Co., Ltd.		923
Siemens Bros., Ltd.		1,279
Sirius-Werke		1,386
Johnson & Phillips, Ltd.	(sample not submitted)	777

Bermondsey.—The B.C. has accepted tenders as follows:—

British Thomson-Houston Co.—Ordinary meters and two-rate meters and time switches.
Reason Manufacturing Co.—Demand indicators.
General Electric Co., Ltd.—Cut-outs, sealing troughs and terminals, and standard fuses.

Poplar.—The B.C. has accepted the tender of the Worthington Pump Co., at £218, for a motor-driven feed pump at the Main Station.

Salford.—The T.C. has accepted the tenders of the following for the annual supply of the under-mentioned articles for the Electricity Committee:—

Asphalt bridges.—W. Turner (Ardwick), Ltd.
Circuit breakers.—Cowans, Ltd.
Switches and cut-outs.—Electrical Co., Ltd.
Bitumen cables and bare copper stranded wire.—W. T. Glover & Co., Ltd.
Stoneware conduits.—H. R. Mansfield.
Stoneware conduits and stoneware pipes.—Albion Clay Co., Ltd.
Tinned copper strip.—John Bassett.
Copper fuse wire and white tape.—Johnson & Phillips, Ltd.
Mica sheets, rubber gloves, rubber overshoes and rubber caps for cables.—L. Andrew & Co.
High and low speed motors ½ to 7½ H.P.—Veritys, Ltd.; and General Electric Co., Ltd.
High and low speed motors 10 to 15 H.P.—Electric Construction Co., Ltd.
High and low speed motors 20 to 50 H.P.— Lancashire Dynamo and Motor Co., Ltd.
Twelve single-phase house transformers.—Hanchett Barratt & Co., £2 10s. each.

Southampton.—The T.C. has renewed the annual contracts with Messrs. W. T. Glover & Co. and the Craigpark Electric Cable Co., Ltd., for the supply of cable.

Warrington.—The T.C. has accepted the following tenders:—

J. Howden & Co., Ltd.—1,000-KW. turbo-alternator, £4,255.
British Westinghouse Electric and Manufacturing Co.—750-KW. rotary converter, £1,850.
Cowans, Ltd.—Switchgear, £506 1s.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Glasgow Section).—Tuesday, May 10th. At 8 p.m. At 207, Bath Street, Glasgow. Annual general meeting.

Junior Institution of Engineers.—Wednesday, May 11th. At 7.30 p.m. At the Royal United Service Institution, Whitehall, S.W. Paper on "Notes on the Running of an Electricity Works," by Mr. L. M. Jockel.

Institution of Electrical Engineers (London).—Thursday, May 12th. At 8 p.m. Paper on "Street Lighting by Modern Electric Lamps," by Mr. H. T. Harrison.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

THE following orders are announced:—

Commanding Officer—COL. R. E. B. CROMPTON, C.B.

Monday, May 9th.—"A" Company. Recruits' infantry drill, 6 to 6.45 p.m.; company drill, 7 to 9.30 p.m.
Tuesday, May 10th.—"B" Company. Company drill, 7 to 9.30 p.m.
Wednesday, May 11th.—Gymnasium, 6 to 9.30 p.m.
Thursday, May 12th.—"C" Company. Recruits' infantry drill, 6 to 6.45 p.m.; company drill, 7 to 8 p.m.; technical drill, 8.45 to 9.45 p.m.
Friday, May 13th.—"D" Company. Recruits' infantry drill, 6 to 6.45 p.m.; company drill, 7 to 8.30 p.m.; technical drill, 8.45 to 9.45 p.m.

(Signed) J. H. S. PHILLIPS, Capt. R.E., Act. Adjutant.
For O.C. E.E., L.D.

NOTES.

"New Engine of War."—Under this heading the *Daily Express* exhausts the resources of the English language in its effort to impress the artless British public with the devastating powers of "the torpedo of the air." The modern reporter, in presence of an engineering invention, is like a child—a very young child, who has not read the "Children's Encyclopædia"—at the pantomime. The marvellous feats performed on the stage, the gorgeous scenery, the weird creatures, all seem real, and afford food for wild flights of the imagination into the realms of fairyland. So the reporter, carried away by enthusiasm (real or simulated), is not content to restrict himself to sober facts, but must needs develop inventions of his own of the wildest and, to anyone who thinks, the most ridiculous description.

A Mr. T. R. Phillips, of Liverpool, on Sunday gave a demonstration of the capabilities of a model dirigible balloon, within the calm and safe environment of the London Hippodrome. Controlled by wireless transmission, the model executed various manœuvres, rising and falling, turning and stopping, and dropping a shower of paper bombs. The principles on which such devices operate are well known.

The inventor, of course, made the usual extravagant claims, unmindful of the influence of wind and weather on such a machine if manœuvred out of doors, and the impossibility of controlling it, even in a dead calm, when it got out of sight; but his imagination was far out-classed by that of the gifted reporter, whose mind's eye saw in the future "a fleet of aerial torpedoes whose master can send them to wreck a town 500 miles away, while he smokes a cigar and fingers a keyboard." What foolish nonsense this is

An Objection to Electric Lighting!—In an action by the Queen Anne Residential Mansions Co., against the Metropolitan District Railway Co., tried last week before Mr. Justice Walton in the King's Bench Division, the plaintiffs sought an injunction restraining the defendants from erecting shops on the land adjoining the St. James' Park Station, which is immediately opposite the mansions. In the course of the evidence given for the plaintiffs, the manager to the Mansions Co. raised a number of objections to the proposals of the Railway Co., and amongst them was the unique contention that electric light might be used by the shops, and if used for either outside or inside illumination, it would, in his opinion, be injurious to the plaintiffs' property by becoming a nuisance to the residents. Counsel for the defendants, apparently surprised at this declaration, cross-examined upon it, and the witness supplemented his assertion by stating that in some thoroughfares through which electric tramways passed, the property was depreciated in value by the lights of passing cars.

Municipal Contracting.—The annual dinner of the Birmingham Centre of the Electrical Contractors' Association was held on April 22nd, Mr. A. Baxter presiding. Mr. Finley (president of the Association) proposed the toast of "The Association."

According to the *Birmingham Daily Gazette* Mr. Tate, who responded, said that since he joined the Association a year ago 80 new firms had joined. Unfair municipal competition got worse every day, and it was only by combination that contractors could bring the matter to an end. The central board of their own Association had been in negotiation with the Municipal Corporations' Association to see whether they could come to some understanding and limit the doings of municipalities to their proper functions. Municipalities should have certain work which the contractors could not do. Let municipalities have power to supply electric motors and electric apparatus on hire, but only on the strict understanding that they should be erected for the consumers through the trade. It was a great hardship that ratepayers who were traders and had spent money on fitting up showrooms should have their living taken away from them.

Tramway Club Concert.—The second Grand Evening Concert of the Metropolitan Electric Tramways Athletic and Social Club was held on Thursday last week at the Alexandra Palace. The military band of the Metropolitan Electric Tramways, Ltd. (bandmaster, Mr. W. A. Cock), which provided the major part of the entertainment, was in great form, and rendered a very creditable performance which it was a pleasure to follow. A number of well-known artistes (Madame Mary Conly and Miss Gertrude Lonsdale, and Messrs. John Bardsley and Reginald Gooud) had no reason to be displeased with the reception which the very large audience accorded to them. An unrehearsed item in the programme consisted of an unsolicited testimony to the drawbacks of systems of illumination other than electric, for during the second piece rendered by the band—"William Tell," most impressively given—as the roaring of "Heaven's artillery" rent the air one of the mantles of a large pendant gas lamp right in the line of everybody's observation gave up the ghost, necessitating a pair of high steps and a busy attendant to replace it—with, to us, interesting smoke and smother—distracting attention from the birdlike passages of the flute, the serious theme of the pipe, the call to arms and the triumphant quickstep of Rossini's last and greatest opera.

International Electrotechnical Commission.—A Canadian branch of the International Electrotechnical Commission has been formed. Prof. L. A. Herdt, head of the Electrical Engineering Department of McGill University, Montreal, has been elected chairman. The other members are professors of the various Canadian Universities, Messrs. John Murphy, electrical engineer of the Railway Commission, Ottawa, and O'Higman, chief electrical engineer, Electrical Standards Laboratory, Ottawa, and several other gentlemen of lesser note. The present Committee is the first move made in Canada in this direction, although, in 1906, Prof. Herdt was the Canadian representative at the inaugural meeting in London, and last year O'Higman, of Ottawa, attended the meeting.

National Electrical Manufacturers' Association (Incorporated).—The secretary, Mr. F. B. O. Hawes, writes with reference to the meeting which this Association is convening on May 23rd next at Caxton Hall, to consider the effect of Free Trade or Protection on the electrical industry, stating that he has received many communications regarding this matter. He asks us to state that the meeting will be a ticket meeting, and that tickets will be sent by the Association to all its members, and to all the Members, Associate Members and Associates of the Institution of Electrical Engineers.

Shock Fatality.—On Thursday morning last week a fatality occurred at the Lambton Collieries Patent Coke and Chemical Works to a fitter named George Bell, 40 years of age. It appears that deceased had made a practice of cleaning the motor each morning at breakfast time. On Thursday morning, when the workmen went back at 8.30, they found Bell lying dead, having apparently received a fatal shock. Deceased had only been employed at the works about two months.

Inquiry.—A correspondent asks where apparatus for varnishing armature core plates can be obtained.

Appointment Vacant.—Borough electrical engineer for Keighley. See our advertisement pages in this issue

Institution and Lecture Notes.—The Faraday Society.—The Society gave their first dinner on Wednesday, April 27th, at the Trocadero Restaurant, in honour of Prof. P. Walden, of Riga, and Prof. Ph. Guye, of Geneva, who came to London for the purpose of taking part in a discussion on "The Constitution of Water," which took place on the previous evening. The President, Mr. James Swinburne, F.R.S., was in the chair, and there was a very good attendance of members and their friends. Among the guests were Sir Joseph Larmor, secretary of the Royal Society; Prof. H. B. Dixon, F.R.S., President of the Chemical Society; and Dr. C. Chree, representing the Physical Society.

Institution of Electrical Engineers (Yorkshire Local Section).—At the annual general meeting of this Section the following were elected as officers for the ensuing session:—Chairman, T. Harding Churton; vice-chairman, Wilson Hartnell. Committee, J. D Bailie, Dr. R. Pohl, H. H. Wright, S. D. Schofield, W. B. Woodhouse, J. W. Hame, E. A. Barker, G. Wilkinson, A. J. Cridge, A. B. Mountain, W. Emmott, J. McFall Smyth.

New Association.—An Association of Electrical Engineering Students has been formed at the L.C.C. School of Engineering, Poplar, E. President, H. A. Garratt, M.I.N.A., A.M.I.C.E.; hon. secretary and treasurer, M. F. Allsop, Student I.E.E., 2, Lyal Road, Bow, London, E. The first paper was read on Saturday, April 30th, by the President, the title being "James Watt." The next paper will be read on Wednesday, May 25th, by the vice-president, Mr. W. W. S. Ibbetson, on "Hydro-Electric Power Stations."

Institution of Civil Engineers.—At the annual general meeting on April 26th, Mr. Alexander Siemens was elected president, and Dr. W. C. Unwin, Mr. R. Elliott-Cooper, Mr. Anthony G. Lyster, and Mr. Cuthbert A. Brereton, vice-presidents.

The Council have made the following awards for papers during the Session 1909-1910:—A Telford Gold Medal to Mr. C. M. Jacobs (New York); a Watt Gold Medal to Mr. J. D. Watson (Birmingham); a George Stephenson Gold Medal to Mr. D. A. Matheson (Glasgow); Telford Premiums to Messrs. F. C. Buscarlet (Sunderland), A. Hunter (Glasgow), I. C. Barling (Tynemouth), J. Dalziel and J. Sayers (Derby); and J. Shaw (Birkenhead); and the Manby Premium to the late Mr. C. W. Hodson (London).

The "James Forrest" lecture this year will be delivered on June 22nd, by Sir J. Gavey, on "Recent Developments of Telegraphy and Telephony."

Institution of Mining Electrical Engineers.—A meeting of the South Wales branch of the Institution was held at Cardiff on April 30th, when Mr. W. J. Richards read a paper on "Colliery Cables"; a discussion followed, and Mr. Theo. Schronthiel, of Cardiff, exhibited a joint box and fittings. The novel feature was the method of bonding employed. The first annual dinner of the branch was afterwards held, Mr. Sydney F. Walker presiding. Souvenir menu cards were designed and compiled by the secretary, depicting on the front cover the production and distribution of coal, and containing a menu set out in technical terms.

Institution of Electrical Engineers (Birmingham Local Section).—The Committee has prepared the following list of officers to act during the Session 1910-11:—

Past Chairmen.—R. A. Chattock; Gisbert Kapp, M Inst.C.E.; R. K. Morcom, A.M Inst.C.E.

Chairman.—M. Railing.

Vice-Chairman.—A. M. Taylor.

Ordinary Members of Committee (remaining in office).—J. H. Barker, J. P. Kemp, Dr. M. Kloss, J. F. Lister, F. J. Moffett, Dr. W. E. Sumpner.

Ditto (new nominations).—W. C. Goodchild, W. J. Larke, F. M. Lea, D. K. Morris, Ph.D., C. E. C. Shawfield, R. Turelfall.

Hon. Secretary.—H. B. Matthews.

Royal Institution.—The annual meeting of the members was held on Monday afternoon. The annual report showed that 33 new members were elected in 1909, and 63 lectures and 20 evening discourses were delivered. The following were unanimously elected as officers for the ensuing year: President, the Duke of Northumberland; Treasurer, Sir James Crichton-Browne; Secretary, Sir William Crookes.

Junior Institution of Engineers.—A numerously attended excursion of this Institution took place recently to Southampton for the purpose of visiting the new 16-acre dock works which are being carried out for the London and South-Western Railway Co., and the s.s. *Teutonic* of the White Star line.

What is the Actual Saving?—It is reported that the Edinburgh Town Council has given a contract to a German firm for insulated cables for one year at £5,202, although this price was only £60 less than a British tender. We hesitate to write on this point in absence of knowledge of the full circumstances, but it seems incomprehensible that the Corporation can have arrived at this decision purely to save a paltry 1 per cent. If that is the only consideration that has weighed with it, we can only say that our views as expressed in connection with a similar case at Glasgow (see our issue of January 28th, page 122, "Fair Consideration for the British Tenderer") apply to Edinburgh too. Prices can only be fairly compared when all tenderers are called upon to comply with the same conditions as to hours of labour, rates of wages, &c.

The Electrical Engineers, London Division.—The Corps Sports and Championships will take place at the London County Athletic Grounds, Herne Hill, on Wednesday, May 25th, commencing at 6.30 p.m. Events, 100 yd., 440 yd., 880 yd., and 1 mile running. ¼-mile, 1 mile and 5 miles cycling, 120 yd. hurdles, long jump, high jump and tug-of-war.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Salford Electricity Committee report have accepted with very great regret the resignation of Mr. V. A. H. M'Cowen, of his position as electrical engineer to the borough. At the same time they express their sympathy with him in the continued ill-health which has led to his resignation, and hope he may soon be restored to his usual health to enable him to continue a career which has been both honourable to himself and of benefit to the public. The Committee further placed on record their high appreciation of the able and efficient manner in which Mr. M'Cowen had fulfilled his duties and the sound advice he had always given to the Committee, thereby rendering valuable service to the Corporation and the ratepayers generally.

The Torquay T.C. has received 157 applications for the post of electrical engineer. Mr. S. W. Salt, of Bradford, was elected by 18 votes to 12.

The Electricity Committee of St. Pancras Borough Council has promoted Mr. G. T. Rawson, second clerk, to the position of first clerk, at a salary of £150, increasing annually by £10 to £200.

Mr. J. M. Smyth, borough electrical engineer at Keighley, has resigned on account of ill-health. The Electricity Committee has accepted the resignation with regret, and a successor is to be advertised for at a salary of £250 per annum.

The Tramways Committee of Northampton T.C. has recommended that the salary of Mr. J. F. Cameron, electrical engineer, be increased from £170 to £180 per annum, rising at the end of a year to £200.

On April 12th, Mr. Percy A. Spalding, engineer and manager to the Galway Electric Co., Ltd., was married to Miss Betty Costello, daughter of Mr. Thomas Costello, of Galway. Mr. Spalding was presented with a marble chiming clock and a pair of bronze figures by the staff and employés of the company.

At a meeting of the Acton District Council on Tuesday, consideration was given to a recommendation of the Electricity Committee, that Mr. J. Martin Blair, the electrical engineer, be requested to send in his resignation, to take effect at the end of three months. Councillor Boissonnade moved, and Councillor Withers seconded, that the recommendation be referred back to the Committee, on the ground that at the Committee meeting there was nothing on the agenda to indicate that such a motion would be brought forward. The chairman (Mr. H. S. Schultes Young) said it was he who moved the resolution at the Committee meeting. Councillor Crane (vice-chairman), in opposing the recommendation, said that if they confirmed the Committee's resolution, they would damn the electrical engineer's career. In reply to a question, the chairman said the electrical engineer's salary was £350 per annum, with emoluments, which brought it up to about £400. Councillor Poulton pointed out that the deficit for 1908-9 in connection with the electricity undertaking, was between £4,000 and £5,000. For the last 12 months it was only £750, and, therefore, it was unfair that the engineer should be dismissed. On the matter being put to the meeting, 9 members voted for, and 12 against. The recommendation was therefore not carried.

Mr. Glynn Salter has resigned his position as resident engineer and secretary of the Lymington Electric Light and Power Co., having been appointed engineer and manager to the Borough of Hamilton Electricity Supply.

Mr. Wm. Hainsworth was on April 23rd the recipient of a travelling bag, presented to him by the members of the office staff of the Yorkshire Electric Power Co., on the occasion of his leaving to take up the position of chief clerk to the Kilmarnock Corporation electricity and tramways department.

General.—Last Saturday week the employés of the Aberdeen Electrical Engineering Co., Ltd. presented Mr. Albert Auer, who, as already announced, is leaving to take up practice in Aberdeen as a consulting electrical engineer, with an oak office cabinet. The presentation was made by Mr. Botting, manager, who alluded to Mr. Auer's 9½ years' service with the firm, and his experience in carrying through a large number of contracts, including many important ones, such as that at the Waldorf Hotel, London, Kingseal Asylum, &c.

Mr. Chas. E. Guarer, who has been for many years identified with conduit practice with leading firms, has severed his connection with Messrs. Simplex Conduits, Ltd., and is now occupying his attention with improvements in conduit and installation practice generally.

Mr. G. H. Edwards has been appointed by the Edison & Swan United Electric Light Co., Ltd., as their representative for Manchester and district, in place of Mr. F. P. Cox, who has now left the company.

ELECTRICITY IN COLLIERY SINKING OPERATIONS.

Sinking operations connected with a colliery are necessarily of a very arduous description, and any plant used in such work receives the minimum of skilled attention. It must therefore be of a nature which can withstand rough usage and continuous service, and under such conditions it would at first sight be thought that electricity was hardly the most suitable means of utilising power in this connection. A considerable number of advantages, however, attach to the electrical method, and there are many occasions on which it can be advantageously adopted.

Among the advantages pertaining to electric sinking the principal are the following:—There are no steam pipes in the shaft; this is a very important consideration, inasmuch as additional piping has to be fixed as the depth of the sinking increases. Another point is that modern electric sinking pumps are so designed that the rising main can be supported on the pump, thus making the operations of sinking considerably easier than where the rising main has to be attached to the side of the shaft; while a third point is that the efficiency of electric sinking is in the great majority of cases very much greater than that of steam sinking, owing to the fact that in the latter there are large radiation losses in the steam piping used, together with a considerable further loss due to leakage and other causes. On these accounts, therefore, it would appear that the electrical method has distinct advantages over its older rival.

Fig. 1.—Sinking Plant at the Hamsterley Collieries.

Where centrifugal pumps are used, a continuous-current motor has the great advantage that its speed can be varied over a very wide range, without any trouble due to sparking on the commutator, provided that modern motors, equipped with inter-poles, are used. Generally, a sinking pump will have to deliver the water against a head varying from a few feet to the maximum depth of the sinking, and, in order to secure the greatest possible economy, it is desirable to vary the speed of the pump to suit the particular head against which it has to work. On the other hand, there is no doubt that the ideal motor for sinking work is a three-phase machine, with a squirrel-cage or short-circuited rotor; the reason for this being that such a machine is inherently of a very much more substantial design, and the only attention required by the machine in running is the lubrication of its bearings. This, in view of the rough usage and, very frequently, lack of skilled supervision to which such plant is subjected, is a very important point.

Where new generating plant is being put down in order to drive the sinking motor, and where such plant is of a large size, it is possible to put in an installation such as that to be described later, which will enable a three-phase motor to deal as economically with a varying head as a continuous-current machine, but in order to do this it will be found necessary to set aside at least one generator to operate each sinking pump, and it therefore follows that the pumps must be of a very considerable size in order to justify such an arrangement. Where only small quantities of water have to be dealt with, more especially if this is against a medium or high head, a three-throw ram pump could be installed in preference to the centrifugal type, as the ram pump is less affected by grit and foreign matter than is the centrifugal and is more easily looked after. Another most important advantage is that the ram pump is capable of priming itself, whereas the centrifugal type frequently involves a considerable amount of trouble in starting in order to get the water to pass, should the foot valve be wedged open by stones or dirt. It has been found as a matter of experience that where the quantity of water exceeds 300 or 400 gallons per minute the ram pump, as a rule, becomes too cumbersome for sinking purposes, and the centrifugal type is adopted in preference. Another point in favour of the ram pump may, however, be mentioned incidentally, which is, that it is not necessary to vary the speed of such a pump as the head varies in order to get economical working.

Where it is decided to adopt a ram pump for delivering small quantities of water against a high head, the usual method of drive for a pump hanging in the shaft is to mount the totally enclosed motor at the top of the pump, and drive the pump through spur gearing (fig. 4). It is also usual to mount the switchgear on the pump set.

An installation recently carried out by Messrs. Ernest Scott & Mountain, Ltd., at the Hamsterley Collieries, is a very good instance of one of those cases in which considerable advantages have been gained from the use of an electrical installation. In this case the colliery owners were sinking a small shaft about 1 mile from their main colliery, and it

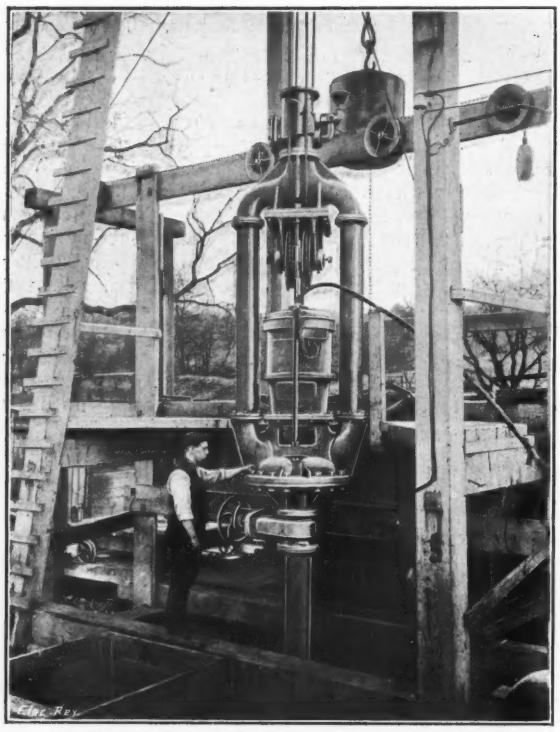


Fig. 2.—Scott & Mountain Turbine Sinking Pump at Hamsterley.

was expected that the shaft would be approximately 100 ft. deep, and that there would eventually be a feeder of about 500 gallons of water per minute to be dealt with. The main colliery had already its own generating plant, supplying three-phase current at approximately 550 volts pressure, and a frequency of 50 cycles per second, and by utilising this plant it was possible to carry out the whole of the sinking of the new pit without installing any boilers at the site. The arrangement of the plant which was installed for this purpose is shown in general appearance by fig. 1. On the right-hand side of the first illustration will be seen the winch house, containing two electrically-driven winches for raising and lowering the kibble and the sinking pump respectively. The current is brought into this winch house through an overhead transmission line of the usual type, consisting of bare copper wires run on poles, and the switchgear for starting and stopping the pump is contained in the same winch house, so that the man in charge of the winches can also control the running of the pump.

The two winches with their motors are duplicates of one another, and each is designed to raise a load of 25 cwt. at a speed of 40 ft. per minute. The winch for the kibble raises its load direct, the rope passing over a single pulley on the head gear, but as the sinking pump is considerably heavier, the rope for this passes over an arrangement of pulleys on the head gear and pump which gives a 4 to 1 reduction, so that the greater load of the pump can be dealt with, and the pump raised when required at about one-quarter of the rate of the kibble. Each winch is driven by a 10 to 15 H.P. three-phase slip-ring 500-volt motor, running at a synchronous speed of 750 R.P.M., and provided with a reversing controller. The motor is coupled direct to the first-motion gearing, and is provided with a brake on the motor shaft with a foot lever. In addition to this brake, a further brake is put on the drum shaft of the winch as an additional precaution against accident. Each winch is also provided with a three-pole switch, fuse and ammeter, placed close to the driver, so that in the event of necessity he can cut off the whole of the current to the machines. As in an installation of this sort it is possible that the blowing of a fuse, or an accident to the transmission line, might cut off the supply, involving considerable delay, each motor is fitted with an extended square shaft, and suitable handles are provided, so that in the event of a failure of supply the men at bank can raise the kibble or pump by hand.

The general arrangement of the sinking pump and motor is shown in the accompanying illustrations, figs. 2 and 3. The set consists of a vertical-spindle squirrel-cage three-phase motor of 30 B.H.P., running on 500 volts at 50 cycles per second, and coupled direct through a solid coupling to a single-stage turbine centrifugal pump, designed to deliver water against a 90-ft. head, but actually capable of delivering against over 100 ft. head. The motor is of the ventilated splash-proof type, with a fan mounted on its shaft, arranged to draw in air at the bottom and force it up through the casing.

The motor has been designed to start on the compensator, and it has had to work under very arduous conditions, as it has frequently been started and stopped at intervals of about two minutes. The weight of the rotor is carried on a ball thrust bearing placed at the bottom of the pump, with a steadying bearing upon the top, and as the pump spindle is bolted direct to the motor spindle, the weight of the rotating parts of the pump is also taken by the same thrust ball bearing.

The pump is capable of working with as much as a 24-ft. suction, although, of course, the quantity of water delivered by the pump falls off very considerably under such extreme conditions. The outlet is fitted with a non-return valve provided with a by-pass for priming purposes. The suction of the pump is about 20 ft. long, and is provided with a sluice valve for throttling and adjusting the quantity of water delivered, together with a foot valve and strainer.

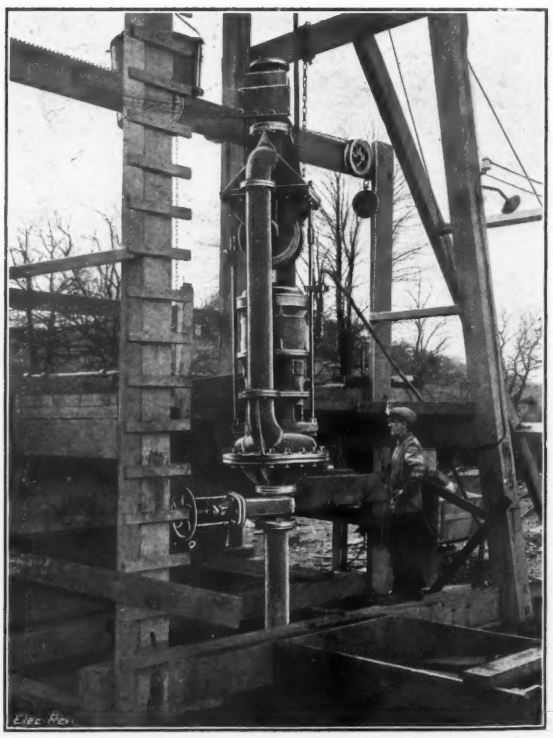


Fig. 3.—Another View of the Pump shown in Fig. 2.

In all sinking work the design of the foot valve is of very considerable importance, and it is necessary for it to be as short and as compact as possible, so as to reduce to a minimum the depth of water in which the sinkers have to work. In a small shaft such as is now being described, with a feeder of 500 gallons per minute, it is known that, if the pump

stops, the water will rise at the rate of about 1 ft. per minute, and the sinkers have always to be working in about 1 ft. to 18 in. of water.

A very important advantage of the method of using a sinking pump with the rising main supported by the top of the pump, is that, as the sinking proceeds, additional lengths of piping can be added at the top of the shaft, and the pump lowered with a very slight interruption of pumping operations. If, however, the piping has to be connected to the shaft side, it is necessary, every time an additional length of pipe is needed, to drain the column into the shaft, which is already filling with water from the feeder, and then to add an additional length and couple up the rising main to the pump again. In the Hamsterley case it is very doubtful whether this set of operations could have been done, inasmuch as the water rose so rapidly when the pump was stopped that sufficient time could not have been allowed.

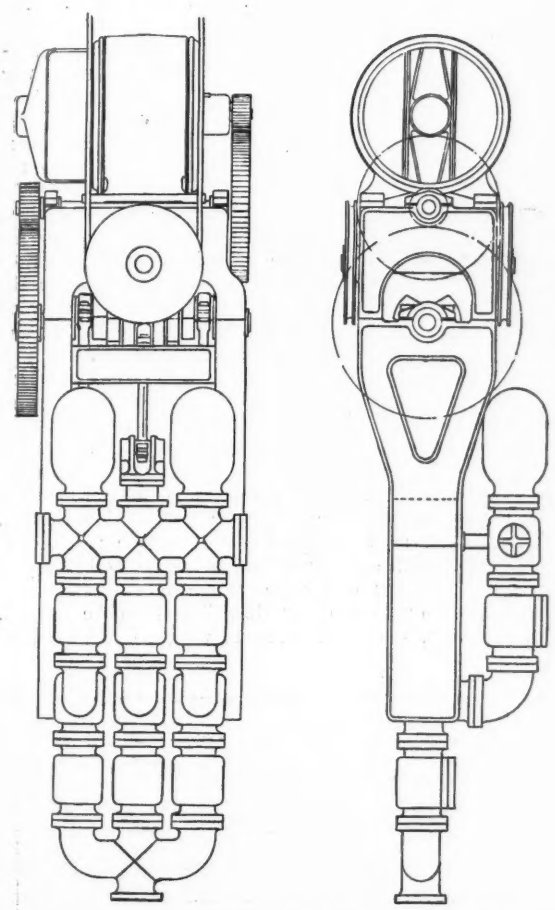


Fig. 4.—Electrically-driven Ram Sinking Pump.

It may be interesting to give another example of a typical economical installation of large size, and this is afforded by work which has recently been carried out for the Newbiggin Colliery Co. In this case each pump set was supplied from a separate engine and generator, provided with a governor for adjusting the speed of the alternator, so as to run the motor and pump at any required speed. In such an installation a separately-driven exciter is necessary, as an ordinary coupled or belt-driven exciter would be too unstable when running at the lower speeds to maintain a steady voltage.

The complete installation at Newbiggin consists of two high-speed compound engines coupled to 315 K.V.A. 550-volt 40-cycle three-phase alternators. Each exciter consists of a 30-B.H.P. engine coupled direct to a 17-KW. dynamo at 220 volts, and is capable of exciting both alternators to their full capacity.

There are one or two special arrangements in connection with the switchboard, which is fitted with the usual instruments and switches for controlling the three-phase alternators. As the pumps may be worked at different heads, the switchgear can be divided into two sections, each controlling a feeder for one pump and the switchgear for one alternator. A synchronoscope is provided, together with a paralleling switch between the bus-bars, so that, if required, the two alternators can be run in parallel, and either alternator can be connected to either of the pump sets. Separate continuous-current bus-bars are provided for excitation purposes, and here again the continuous-current sets can supply the field of either alternator, and are also capable of being run in parallel.

With a separately excited generator no starting compensator or other starter is required. It is only necessary to switch the full field of the alternator in, close the circuit to the pump and start up the set; the pump then runs up to speed with the alternator, without taking any excess current. Where this cannot be done, it is generally necessary to provide a compensator having several stops, in order to avoid an undue rush of current. In all probability the compensator will be placed at bank, and in addition to the necessary switchgear in that position, it is always desirable to have a three-pole main switch mounted on the motor itself, so that in case of emergency the attendant can stop it.

In some cases the motors for sinking pumps, such as described above, of the squirrel-cage type, are water cooled, the water from the pump passing round the motor casing and into the Y piece at the top.

Where the sinking operations are important and interruption would be serious, it is desirable to have a duplicate pump slung, either in the shaft, or, at any rate, ready for lowering into the shaft, as a stand-by, and in addition to have stand-by generating plant.

The voltage of supply for three-phase sinking installations is a somewhat important point. While such plant has been operated at 2,000 volts for sizes of, say, 300 H.P., delivering 1,000 gallons per minute against a 600-ft. head, it seems desirable to work at a lower pressure—say, not more than 650 volts, if possible—much depending on the weight of cable to be handled.

Somewhat analogous conditions to those above described in sinking a shaft exist in the case of unwatering an existing shaft. Motor-driven centrifugal pumps are very suitable for such a purpose, as the conditions are very much less arduous than in sinking a new shaft, where it is impossible to avoid the wear due to grit and dirt in the water.

ELECTRICALLY-DRIVEN MINE FANS.

It is not very long since many of the mines of this country were ventilated by means of furnaces, a primitive and unsatisfactory method, which was gradually superseded by the use of mechanical ventilators in the form of low-speed steam-driven fans of the paddle-wheel and curved deep-bladed type. These fans were very large in diameter, and, involving a great amount of structural work, were costly to install. Further, they gave very low efficiencies as compared with those of the present day. As the design of the fans progressed, not only did the efficiencies improve, but the diameters of the wheels decreased, while the rotating speeds increased. In place of the low-speed type of engine, those of comparatively high speeds could now be employed, a decided advantage as far as mechanical efficiency and first cost were concerned. Simultaneously with the employment of high-speed engines for fan operation came the more general application of electricity to mining work, and it was only natural that motors should be employed for this particular purpose. Progress, however, was very gradual, the mining authorities preferring in many cases to use steam, chiefly because the necessary power could be developed for less coal per hour than if transmitted electrically, and because this meant a not inconsiderable saving in the case of mine fan operation, which was steady and practically continuous. Further, steam was plentiful in most collieries, and often an additional boiler plant did not come amiss for burning a

certain class of low-grade fuel, which was almost unsaleable, but still had to be brought to the surface.

The more general application of electric motors on the surface and underground, the development of power companies in the mining districts, and the installation of private power stations, largely eliminated the isolated boiler plants, which occupied so much space at the pit head, and necessitated the employment of many men for their attendance. From the electrician's point of view the employment of

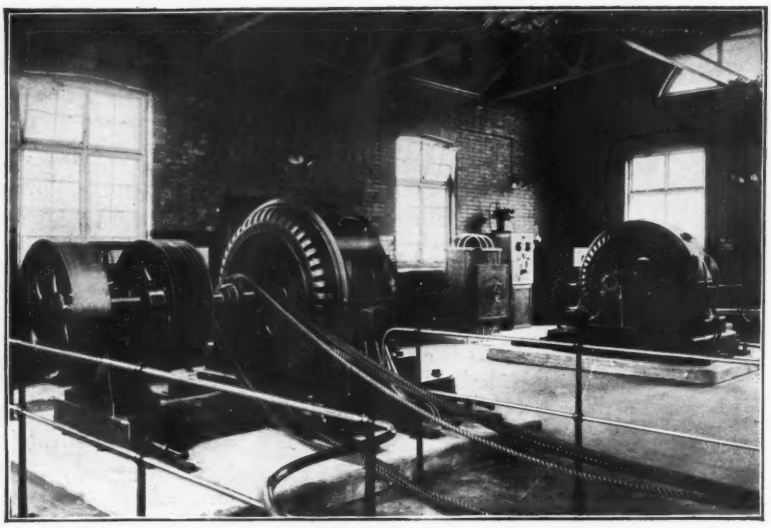


Fig. 1.—Interior of Fan House at Ferndale Colliery, Showing Duplicate Motors for Driving the Sirocco Fan.

electric motors for fan driving was highly advantageous, as the steady and continuous running of the fan partly compensated for the fluctuating load of the haulage motors.

Turning now to the special features of mine fan driving, almost the first problem encountered is the question whether a surface fan should be direct-coupled or rope driven. As has been stated above, the modern mine fan operates at a comparatively high speed, and is accordingly in many cases suitable for direct-coupling to motors, without involving the use of large frames and consequently expensive machines which would have to develop their power at a relatively low speed. Direct-coupling is obviously the most efficient arrangement, since it eliminates the losses in the rope drive, which Mr. Patchell, in his careful test of a "Sirocco" fan at Ferndale Colliery, South Wales, showed to be 8 per cent. of the full output of the motor. On the other hand, where three-phase motors are in use—and the majority of collieries are equipped on the alternating-current system—there is the difficulty of reducing the volume of air at week-ends or at holiday times, owing to the motor being a constant-speed machine, which is not adapted for speed regulation except under uneconomical and inefficient conditions. There is more flexibility to be obtained with rope drive. For temporary variations of load, such as the reduction at week-ends, this arrangement permits of the use of a smaller motor, which, connected to the fan by means of a second pulley, can work efficiently at full load when the full duty of the fan is not required. The safety of all the men underground depending so largely on the constant running of the fan, the liability of breakdowns must be avoided at all costs, and for this reason, where duplicate surface fans are not in use, duplicate motors are generally provided for a single fan. In the case of direct-coupled sets they are placed at each end of the shaft, with intermediate clutch couplings; in the belt-driven arrangement the pulleys, of course, take the place of the motors at the ends of the shaft. Fig. 1 shows this arrangement at the Ferndale Colliery, where a double-inlet Sirocco, 98 in. in diameter, is provided with duplicate 300-H.P. motors.

Another very important problem met with in mine fan work is that of providing sufficient margin of power for the future development of the colliery. In the majority of cases where a new fan is installed, it is designed for a higher duty than is actually required at the time of erection, and consequently the power may at first be half or even less of what will ultimately be necessary to drive the fan at full load. If the margin be very large, it is probable that the development will occupy a number of years, probably 10 or more, and in such a case it is obviously more economical to put down primarily a small motor which can be replaced by a more powerful machine at a later date. The saving in energy due to the small motor working at full load, as compared with a large motor working at quarter or half load, more than pays for the extra expense involved in the purchase of two motors instead of one. But where the development of the colliery is more rapid, the best method is undoubtedly to arrange the fan to be driven by ropes, as the diameter of the pulleys can be changed to cope with the increasing load, while the motor can be run at its most efficient speed.

We have assumed in this article that the alternating-current system has been adopted by the colliery as being the most general form of electrical power distribution in use. We are not concerned here as to whether direct or alternating current is the better, but it is necessary to refer to a difficulty caused by the use of alternating current in respect of mine fan work. The fact that an induction motor cannot be regulated so readily in speed is often troublesome when it is desirable to reduce the amount of air with which the fan has to deal. There are two ways of doing this, either from the fan end, that is to say, by throttling the air volume in the fan drift,

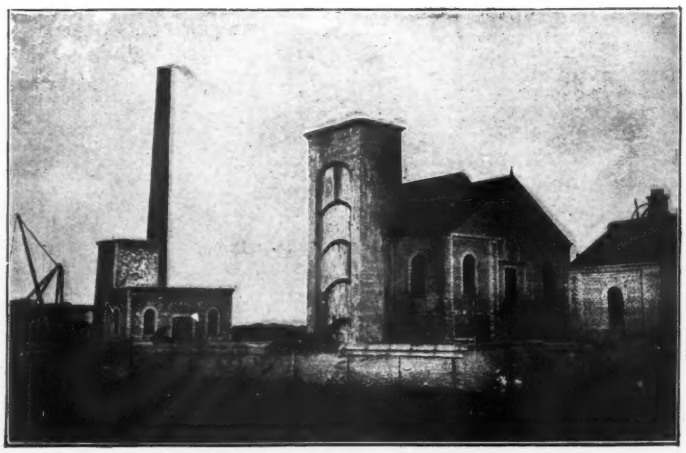


Fig. 2.—Comparison of Steam and Electrically-Driven Fans, 40-ft. Guibal on Right Replaced by Motor-Driven Sirocco on the Left.

or at the motor end, by reducing the speed. Neither is very economical as regards power consumption, which is not reduced in anything like the same proportion as the actual load taken by the fan. Mr. Patchell advocates the introduction of resistance in the rotor circuit in preference to throttling or regulating by cascade, although he admits that the introduction of resistance in the rotor circuit is generally regarded as objectionable. Without going deeply into this question, it must be acknowledged that the curves he

publishes of tests shed a very favourable light on the system he puts forward.

So far surface fans alone have been dealt with, but there is a very large number of less powerful fans now installed

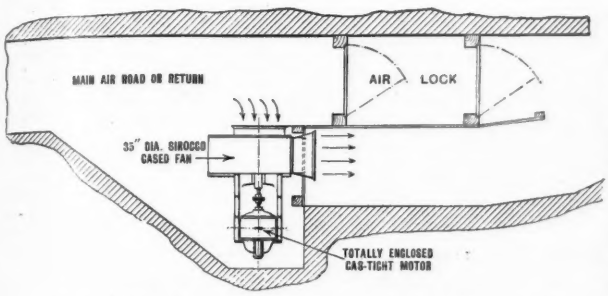


Fig. 3.—Electrically-Driven Sirocco Fan Arranged for Underground Ventilation.

underground. No motive power is more suitable for their operation than electricity, and it may be confidently said that it is owing to the electrical drive that this method of ventilation has become so popular. Water, compressed air and steam have all been used for driving underground fans, but water-power is not often available, compressed air is not very efficient for this purpose, and steam-driven sets, if the enormous condensation losses of a long pipe system are to be avoided, involve the use of boilers underground, an undesirable, if not dangerous, practice, which in the case of fiery mines is also quite out of the question. For use in places difficult of access, a motor-driven fan is ideal, and there are many below the surface at the present time which work night and day, and are only inspected about once in 24 hours. Many mine managers regard the use of auxiliary underground fans with favour, not only because they improve the quality of the atmosphere in the mine at out-of-the-way places, such as dead ends, &c., but also because they assist the surface fan materially, and reduce a great deal of surface leakage. In some collieries, particularly where the coal seams are thin, districts remote from the shafts present much higher resistance than other parts of the mine, and in such cases it would be necessary to operate the large surface fan at a high speed to produce the necessary water-gauge. To meet such a requirement a small auxiliary fan can be used to boost up the air current just where it is needed. It is then only necessary to run the main ventilator on the surface at a lower speed, sufficient to meet the requirements of the remaining parts of the mine. By thus reducing the speed and water-gauge at the main ventilator, surface leakage, which is considerable at high-water gauges, particularly where the upcast shaft is used for winding purposes, is reduced to a minimum. Fig. 3 shows a typical arrangement of an auxiliary fan installed underground.

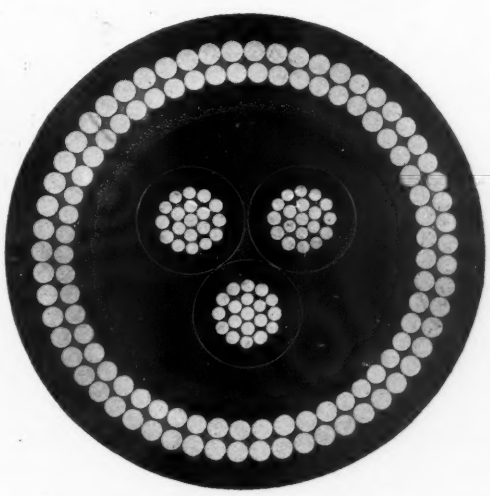
Another class of mine fan, for which electric drive is eminently suitable, is the one used during sinking operations. A small fan is used to blow air through a pipe leading down the shaft which is being sunk. As the air pipe naturally increases in length the lower the shaft is sunk, the duty of the fan correspondingly increases. The most satisfactory arrangement is to drive the fan by means of a variable-speed motor, which can be easily adjusted to the increasing load. A direct-coupled set is preferable, as it occupies little space at the head of the shaft, is easily housed, and can be erected and removed with very little trouble.

To avoid misconception, as repeated allusions have been made to high-speed fans, it may be mentioned, in conclusion, that although the modern type of fan, such as the "Sirocco," operates at a comparatively high speed of rotation, its peripheral speed is, nevertheless, much lower than that of the older types of fans, with the result that the mechanical strain on the wheel is considerably less than in the case of the other types, and this low mechanical strain on the rotating parts ensures a long life for the fan.

ELECTRICAL MACHINERY AND APPARATUS FOR USE IN MINES.

W. T. Glover & Co., Ltd.

Messrs. Glover's wide experience in all classes of cable work has naturally brought them into close contact with the problems more especially associated with the distribution of electrical energy in mines. While they are makers of almost any type of cable, the



Three core Bitumen Insulated Double-wire Armoured Cable.

conditions which obtain in mining, and which often embrace excessive moisture, are, in their opinion, best met by the use of cables of the solid vulcanised-bitumen type, in which the copper conductors of the cable have their interstices filled with a solid bituminous compound which will not run or become displaced by the heating of the cable through overloading.

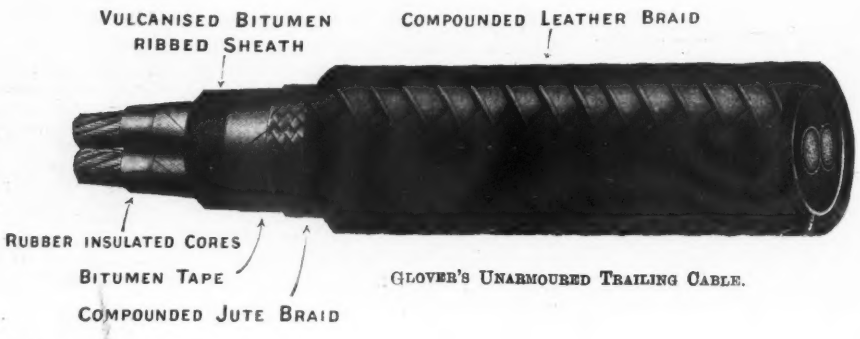
The solid filling obviates the risk of capillary passages for moisture and, therefore, the risk of water entering exposed ends.

Light and Heavy Type Cable Suspenders for Colliery Work.

Messrs. Glover recommend a solid three-core bitumen cable for three-phase work, in which the conductors are each separately insulated with vulcanised compound and laid up round a central core of bitumen, then sheathed with a solid tube of compound

which is ribbed internally to fit the interstices of the laid-up insulated conductors. Such a cable can be taped, braided or armoured as desired.

The advantages claimed are :—(1) Higher insulation and dielectric strength (the effective dielectric between cores and earth is the total thickness of bitumen over each conductor and around the three cores); (2) minimum chance of decentralisation due to overload; (3) greater chemical protection against bad water; (4) greater reliability in wet situations (water cannot creep between the cores); (5) the special construction obviates the introduction of fibrous material in the building up of the cable, which in itself obtains the advantage of a solid system.



GLOVER'S UNARMOURED TRAILING CABLE.

For continuous current Messrs. Glover advise single cables insulated entirely with vulcanised bitumen—no separator—with the solid filled strand.

It is worth noting that Messrs. Glover were the pioneers in the manufacture of these two types of cable—types which are generally favoured for colliery and mining work.

These bitumen cables can be, and are, extensively used for all working pressures up to 3,000 volts, but beyond that pressure impregnated paper insulation, with a sheathing of vulcanised-bitumen compound, ribbed internally to fit the interstices of the laid-up insulated conductors as in the case of the solid bitumen cable, has advantages.

This type of cable, of which also the firm were the pioneers, is much stronger mechanically than the ordinary three-core paper-bitumen cable hitherto used, which consisted of paper-insulated cores made circular with paper or fibrous packing, an overall covering of paper, and then a sheathing of vulcanised-bitumen compound.

For shaft work, a cable double armoured with galvanised steel wires is advisable; it should be cleated at convenient distances by strong wooden cleats at least 2 ft. 6 in. long, chamfered off or umbrella protected, so as to allow water to fall away from the cable and to obviate the collection of coal dust, &c., at the cleats.

For underground work, cable with single-wire armouring—for mechanical protection, and as a means of earthing—suspended to the sides or roof of the roads by means of suitable suspenders at very frequent distances is recommended. Where the roads are very bad, a double wire armouring might be profitably employed. An armouring of double steel tape is sometimes used, but it renders the cable very stiff, and the conductivity of such an armour for earthing purposes is not nearly so good as even a single wire armouring. Unarmoured cables, protected only by heavy braidings, are often successfully used in the underground roads, and there are a great number of pits where they can safely be used. The suspenders must give easily if falls occur, and may be of leather, balata, strongly woven webbed cloth, &c. A very suitable type of wedge suspender has been designed by Messrs. Glovers, which is made in a light form with an easily broken attachment for underground work, and in a heavy type with a permanent strong hook for overhead work.

Trailing cables are usually made up of vulcanised rubber insulated flexible conductors, two, three, or four-core as desired, padded circular, taped, braided, and either spiral wire armoured, leather braided, rope lapped, or hard cord braided. A special type supplied by Messrs. Glover utilises the ribbed sheathing of vulcanised bitumen

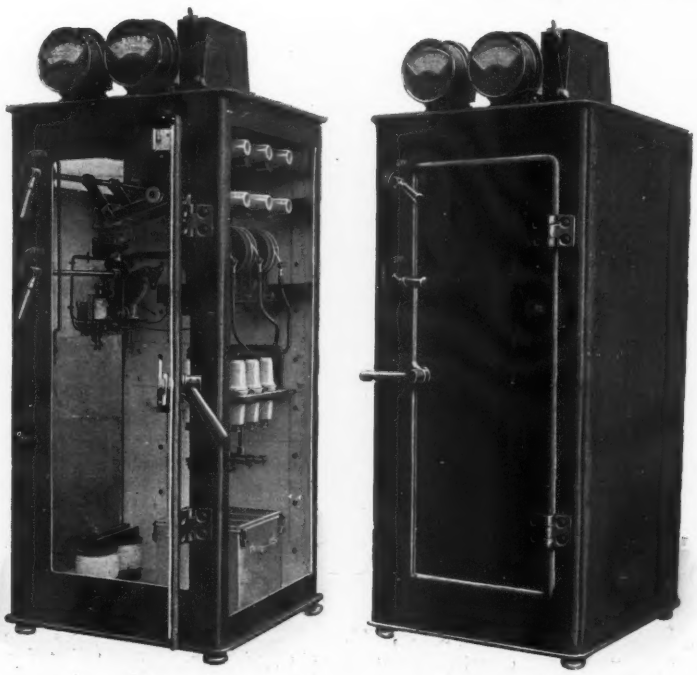


FIG. 1.—HOLMES SWITCH CABINET FOR 3,000-VOLT MINING CIRCUITS.

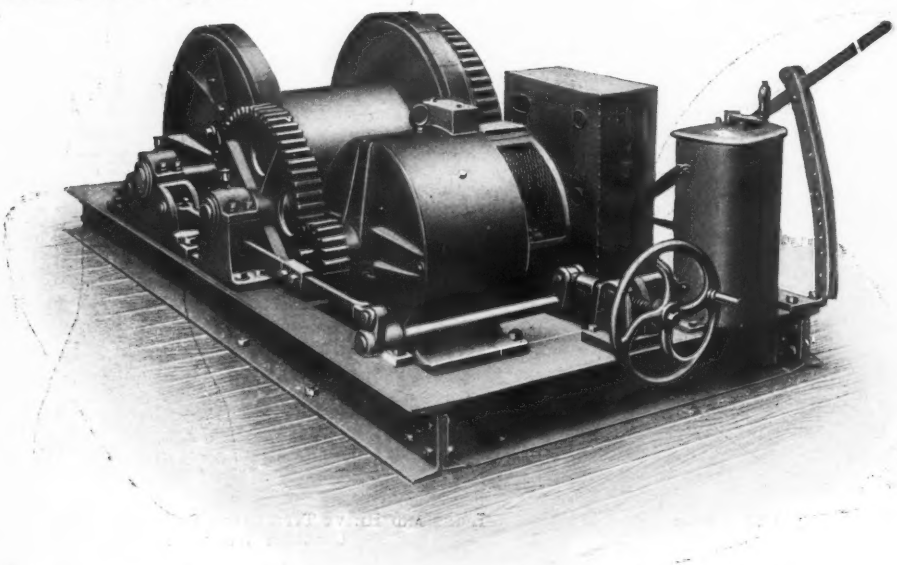


FIG. 2.—HAULAGE GEAR DRIVEN BY 30-B.H.P. "CASTLE" MOTOR.

compound applied over the insulated taped-rubber cores, thus avoiding the use of fibrous packing and rendering the cable considerably more waterproof. The life of such a cable is very considerably longer than that of the ordinary V.I.R. cable, especially in the coal-cutting districts, where moisture abounds at the face. The external protection may be any of the materials previously named, and different collieries prefer different protections as the most suitable for their conditions. Messrs. Glover recommend a non-metallic outside protection, any earth wire being incorporated in the cable.

For use with the Fisher gate-end box, a special trailing cable, with a central pilot core in the middle of the cable and a spiral earth-wire underneath the non-metallic armouring, is manufactured.

Multicore telephone cables, with vulcanised rubber cores and a ribbed sheathing of vulcanised bitumen, are also made for wet shafts, and particularly for gold mines.

Much headway is being made with electrical sinking pumps and lighting, especially for the deeper pits. Great care is needed in the construction of drums to carry the sinking cable, and Messrs. Glover have recently designed and made specially strong drums entirely of iron and driven by worm-gearing. The collecting gear is also entirely enclosed, and is of special design.

Messrs. J. H. Holmes & Co.

Manufacturing in the midst of a mining district, Messrs. J. H. Holmes & Co. were amongst the first to install electrical plant in collieries, and have supplied some hundreds of machines, rated at many thousand horse-power, for this purpose. The arduous conditions experienced in such work have necessitated the development of special designs of switchgear and machinery, some of which are illustrated herewith.

Fig. 1, p. 744, shows a switch cabinet for 3,000-volt mining circuits, consisting of a substantial cast-iron case fitted with sheet-steel panels; on the top are mounted a voltmeter and ammeter, and a trifurcating box for a three-core cable, while inside the case are fitted a three-pole isolating switch and a three-pole main oil-break switch, with overload trips in two phases and no-volt release.

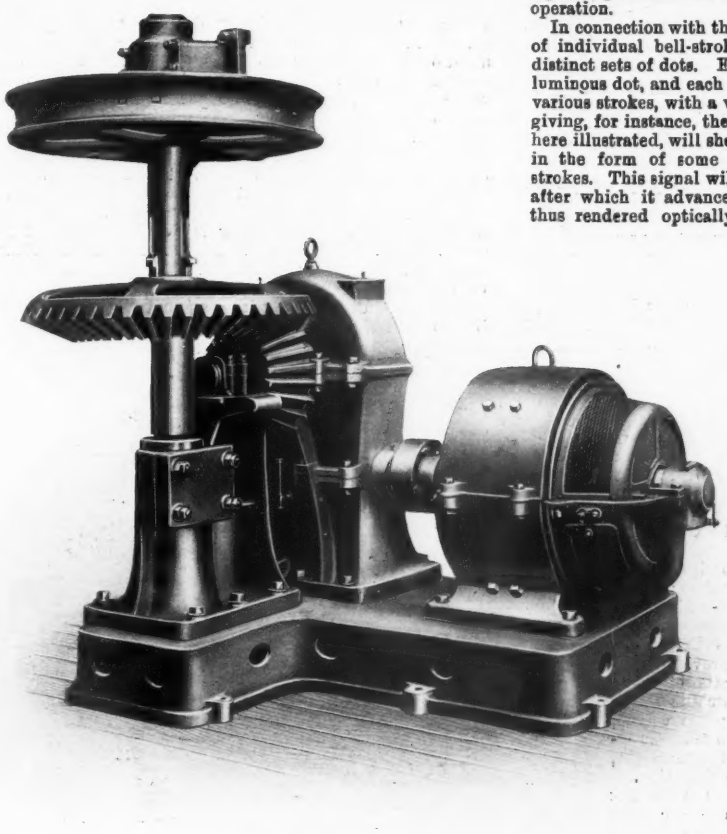


Fig. 3.—Holmes Endless-rope Haulage Gear.

The transformers for the overload-trip coils and ammeter are carried on the bracket seen between the isolating switch (which is near the top of the case) and the main oil-switch below. The transformer for the voltmeter and no-volt trip coil is at the bottom of the case.

The three-pole main oil-break switch is fitted with a loose handle, so that the switch cannot be closed against an overload, and the door of the case is interlocked with the switches in such a manner that the door cannot be opened unless the isolating switch is in the "off" position; the isolating switch cannot be put in this position unless the main oil-break switch is first put into the "off" position; and neither the main oil-break switch nor the isolating switch can be put in the "on" position until the door is closed and locked. The door is fitted with a Yale lock.

Messrs. Holmes also make a simple switch-fuse combination for two or three poles, which is mounted in a cast-iron box on an iron pedestal, for mining work.

An unusual arrangement of haulage gear is shown in fig. 2, which represents a 30-B.H.P. 480-volt 700-R.P.M. ventilated enclosed multipolar "Castle" motor driving gear for hauling tubs out of "dip" workings. The machine is so arranged that the rope-drum can be moved along the bed out of gear (by means of the hand-wheel shown in the foreground), and the load run or lowered down-hill on the brake. The controller and resistance are also mounted on the bed-plate, in order to bring all the operating gear within easy reach of the driver. The gear is mounted on a bed built up of rolled-steel sections, in order to be as light and portable as possible, as it is moved from time to time as working conditions in the mine require. Over a dozen of these sets are in use in mines belonging to a company in Co. Durham.

Fig. 3 shows a design for endless-rope haulage, which has proved very satisfactory, and is highly approved by mining engineers on account of its smooth and silent operation. The motor is of 90 B.H.P., of the ventilated enclosed type, and is arranged to run on a 500-volt circuit at about 575 R.P.M. Worm and bevel reduction gear are arranged to give a speed of about 6 miles per hour to the endless rope.

SIEMENS MINE-SIGNALLING APPARATUS.

The mine-signalling apparatus described in the following has been designed by Messrs. Siemens Bros., and ensures absolute safety by simultaneously giving acoustical and optical signals, as well as a graphical record of both, so as to afford a reliable means of checking. It is readily adapted to any existing impact alarm-signalling installation without any alteration in its arrangement or operation.

In connection with this apparatus the groups of signals, composed of individual bell-strokes, are exhibited optically in the form of distinct sets of dots. Each stroke of the bell corresponds with one luminous dot, and each interval of variable duration between the various strokes, with a variable distance between the dots. After giving, for instance, the signal "Lower slowly," the apparatus, as here illustrated, will show a signal corresponding to the alarm signal, in the form of some optical sign enclosed between two vertical strokes. This signal will remain visible until a new order is given, after which it advances as the new signal appears. The order, thus rendered optically visible, is also registered on a paper tape, so that the kind of order given can be ascertained afterwards whenever desired. The paper-roll (an ordinary Morse telegraph roll) can be readily changed, and, at the rate of about 3,000 signals per day, suffices for five or six working days.

A small lamp is lighted automatically when the paper tape is nearly run out, so as to last only for a few more hours. The apparatus works mainly like an ordinary Morse apparatus; a paper tape is unwound from a roll on to another roll, and at each stroke of the bell a small round hole is punched in the tape, the distance between holes corresponding to the intervals between the various bell-strokes. The punching device has been developed in connection

Siemens Mine-signalling Apparatus.

with the Siemens telegraph apparatus, and has been found to give every satisfaction in operation.

The paper tape is set moving by clockwork wound up automatically at each bell stroke, and which after the last stroke continues running for a short time. This feeding device has also been adopted without any appreciable alteration from the telegraph apparatus.

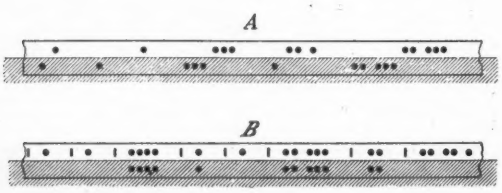
In order to make the signal punched in the paper tape visible at a distance, a considerably enlarged picture of the tape is thrown upon a white screen, immediately after passing the punching device, by means of a projector (similar to that of a magic lantern) which is fitted into the apparatus. This enlarged picture appears behind a window covering the whole width of the apparatus. Each bell stroke is reproduced as a brightly lighted circle about ⅝ in. in diameter on a black background. Two Nernst lamps, of which only one is kept burning, the other serving as a stand-by in the case of failure of the former, are used as the source of light.

The round disks below the window showing the signals serve as level indicators. The lighting of incandescent lamps behind the disks causes a figure to appear corresponding to the level from which the signal comes.

The central disk marked s in a similar manner serves for giving the signal for hauling. These signals, being independent of the rest of the signalling plant, can be omitted.

The figure on p. 745 gives an outside view of the signalling apparatus. The Nernst lamps are arranged on a cast-iron base above the sheet-iron housing. The upper part of the latter contains the clockwork and the paper rolls. At the front wall is arranged a mirror from which the signal is read. Below the mirror there is the level indicator board. The lower part of the housing contains the bell for giving acoustical signals, the projection screen, and a switch-board comprising the cable terminals, fuses, resistances, &c. On the front of the apparatus is provided a list of the orders occurring in operation.

Whenever the pit bank is used as transferring station, the apparatus should preferably be so designed as to allow any signals coming from the pit bank, as well as any orders from underground, to be recorded. The bottom and pit-bank signals are then punched above one another on the paper tape in two different rows, while only the pit-bank signals, which alone determine the execution of orders, appear on the reading mirror. The row of perforations



corresponding to the bottom signals is kept covered on its way below the projector (see tape A). The recording of both orders affords the advantage of allowing the accurate transfer of orders by the banksman to be checked at any time. Whenever, for safety's sake, a point is made of enabling the hauling operator to check the orders given out from the two ordering centres (pit bottom and bank), the apparatus is so arranged as to cause any orders given from the pit bottom to appear optically near the hauling engine, to be confirmed acoustically by the pit bank only in the event of their being destined for execution.

The hauling operator in this case should execute the order only in the case of absolute agreement between the acoustical signal and the optical signal previously received. The optical receiver then indicates and records optically only the pit-bottom signals, whereas the pit-bank signals do not influence the paper tape mechanism.

In case the pit bank wants occasionally also to transmit optical signals to the winding engine, it is provided with a switching key, enabling it to switch over its signalling key to the optical receiver. When the switching key is actuated, an alarm is sounded in the winding-engine room, showing the orders now coming to be exhibited simultaneously by optical and acoustical means, and, accordingly, to be performed without any subsequent confirmation.

In order to allow the orders coming from the pit bank to be distinguished on the paper tape from those coming from the pit bottom, the former are perforated doubly, but only one row of holes is projected (see tape B). If, after the receipt of such a pit-bank signal, a signal is given from the pit bottom, the receiver is switched over automatically with the first stroke of the bell. Only the bottom signals will then be rendered optically, and recorded, whereas the pit-bank signals remain without any influence on the tape mechanism until the switch key is actuated anew.

As each signal, previously to its being projected, has to be punched into the paper tape, the signals visible to the hauling operator must necessarily agree with those recorded on the tape.

A further checking of operation can be effected by printing time marks on the paper tape. For this purpose the apparatus is equipped with a special time stamp as used extensively in connection with fire alarms. In this case time marks are printed automatically on the paper tape in hours and minutes, every 10 or 15 minutes.

MOTOR-STARTERS FOR ROUGH HANDLING.

A new model of motor-starter, specially designed to withstand rough handling, and manufactured by the Felten & Guilleaume Lahmeyerwerke A.-G., of Frankfort-on-Main, is illustrated in the accompanying figures, of which fig. 2 is a general view of a direct-current starter in its simplest form, while fig. 1 is a diagram of connections in which a shunt regulator and no-voltage and overload release devices are included. All parts are made interchangeable; the contacts are arranged round the circumference of

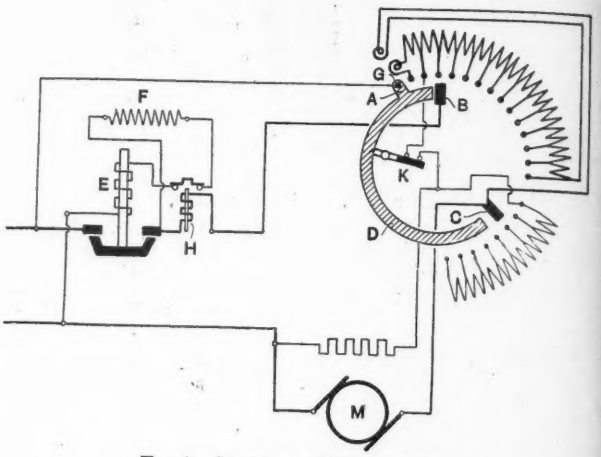


Fig. 1.—Diagram of Connections.

a strong cast-iron wheel, being insulated therefrom by wrappings of leatheroid paper. The actual contacts are of bent copper strip fitted over split tinned iron pins, the spring of which holds the contacts firmly in position. This construction, while being very substantial, permits the copper contacts to be renewed without loosening a single screw.

A strong roller contact (A, fig. 1) is mounted at the extremity of the movable arm of the starter, and is pressed against the inner surface of the fixed contacts by a powerful spring. This arrangement forms a sort of cog-wheel, and causes a slow jerky movement of the starter from step to step; the employment of a worm and worm-wheel or other slow-motion gear is thus dispensed with. The life of the roller is considerably longer than that of a sliding contact working under similar conditions. The powerful magnetic blow-out G fitted to the starter assists in prolonging the life of the contacts, and in the course of a test it was found that after the circuit had been broken at the contacts nearly 100,000 times under twice the

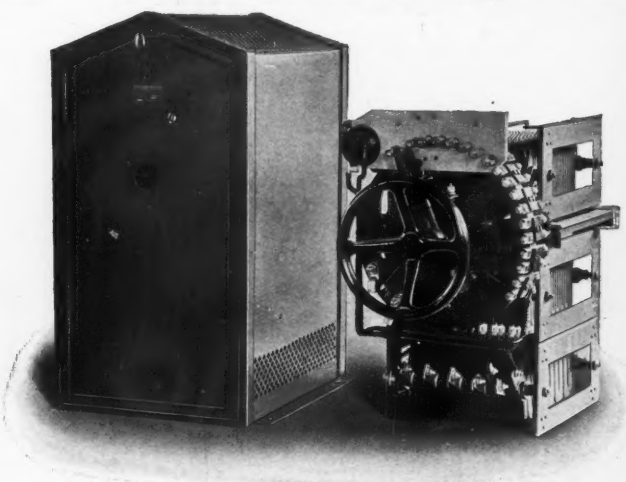


Fig. 2.—Motor-Starter with Cover Removed.

normal working current, the wear of the contacts was so small as to be scarcely noticeable.

It will be observed from fig. 1 that the magnetic blow-out coil is wound in two parts, connected between the first two and the last two contacts of the starter respectively. The first part is in circuit only while the starter lever is on the first contact B, and consists of a comparatively large number of turns of fine wire. The blow-out magnet is thus fully energised, though only a small current passes through the starter; and, consequently, sparking is prevented if, as often happens in the operation of machine tools, the attendant rapidly makes and breaks the circuit on the first contact of the starter in order to produce a very small move-

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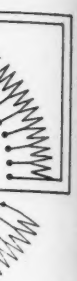

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ment of the machine. The second part of the blow-out coil, consisting of a few turns of thick wire, is connected between the last two contacts of the starter. The full starting current, therefore, flows through this winding, and the blow-out magnet consequently remains fully energised during the whole period of starting.

The resistances are of the Felten & Guilleaume-Lahmeyerwerke standard crane controller type. For the larger sizes of starter they are built up in units consisting of a number of cast-iron grids supported on insulators on an angle-iron framework, while for the small sizes they are of wire wound on damp-proof porcelain tubes. A powerful circulation of air through the resistances is ensured by the perforations shown in the starter casing.

In fig. 1, A is the roller contact referred to above, while B and C are two fixed laminated copper brushes, through which the starting resistances are short-circuited by means of the polished cast-iron contact plate D when the controller is in the full "on" position. The brushes B and C and the plate D thus form a permanent path for the current. The roller contact A rotates about a common axis with the plate D, and is directly connected to it both electrically and mechanically.

If it is required that a speed-regulating shunt rheostat should be embodied in the starter, a number of additional contacts are fitted as shown in fig. 1. Only in this case is the switch contact K introduced; it opens automatically when the roller A comes into contact with the first of the shunt contacts.

The no-voltage and overload release devices shown in the diagram may be mounted in the starter case in the space below the contact way. The circuit-breaker of the no-voltage release is closed by the solenoid E, which is connected in series with the resistance F as a shunt across the mains. The overload tripping coil H is connected up in the usual way, and interrupts the no-voltage release circuit upon the occurrence of an overload. A special feature of the release is that, contrary to the arrangement usually adopted with motor-starting switches, it is mechanically independent of the starter arm, and it consequently does not fail to open the circuit even though the arm be subjected to some external force preventing its return to the "off" position. The electrical connections are, however, made in such a manner that the circuit-breaker refuses to close until the starter arm is returned to its initial position, when the circuit through the solenoid E is again completed through the contact G, the roller A, the iron plate D and the copper brush B.

NEW COMPANIES REGISTERED.

Allen West & Co., Ltd. (108,870).—This company was registered on April 15th, with a capital of £20,000 in £1 shares, to carry on the business of electrical and mechanical engineers, &c. The subscribers (with one share each) are:—A. West, 47, Victoria Street, S.W., electrical engineer; W. J. Mosgridge, 47, Victoria Street, S.W., secretary. Private company. The number of directors is not to be less than two or more than four; A. West is one of the first. Registered office, 47, Victoria Street, Westminster, S.W.

British Arc Welding Co., Ltd. (108,759).—This company was registered on April 11th, with a capital of £15,000 in £10 shares, to carry on the business of welders, marine, electrical, civil and mechanical engineers, electricians, founders, &c. The subscribers (with one share each) are:—J. Kennedy, 11, Fellows Road, Hampstead, N.W., engineer; R. S. Kennedy, 41, Marquess Road, Canonbury, N., engineer. Private company. The number of directors is not to be less than two or more than six: the first are R. S. Kennedy and J. Kennedy; qualification, £200; remuneration as fixed by the company. Registered office, Suffolk House, Lawrence Pountney Hill, Cannon Street, E.C.

Rallophones, Ltd. (108,940).—This company was registered on April 16th, with a capital of £500 in £1 shares, to carry on the business of electricians, telegraph and telephone makers and operators, engineers, wire drawers, tube makers, &c. The subscribers (with one share each) are:—H. von Kramer, 21, Woodend Road, Erdington, electrical engineer; E. Wilson, Glynn Wynne, Penn's Lane, Erdington, Warwick, accountant. Private company. H. von Kramer shall be one of the directors so long as he thinks fit. Registered office, 21, Woodend road, Erdington, Warwick.

Express Cable Inventions, Ltd. (109,071).—This company was registered on April 21st, with a capital of £50,000 in £1 shares, to acquire from H. Knudsen his patents and other rights in certain inventions for transmitting and receiving photographs and printed and typewritten messages by wireless telegraphy and over cables and landlines, &c. The subscribers (with one share each) are:—F. Coulthard, 27, Sylvan Road, Norwood, S.E., solicitor; H. Knudsen, 12, Cyril Mansions, Battersea Park, S.W., engineer; T. E. L. Oakley, 40, Carey Street, W.C., solicitor; W. D. McFaden, 9, Willifield Green, Garden Suburb, Hendon, N.W., clerk; A. J. H. Bowen, 40, Carey Street, W.C., solicitor; W. G. Burghard, 43, New Oxford Street, W.C., clerk; W. A. Sparke, 151, Abbeville Road, Clapham, S.W., managing clerk. Minimum cash subscription £100. The number of directors is not to be less than two or more than ten; the first are Col. H. S. Fitzgerald, B.C., H. C. Hall and T. E. L. Oakley (all permanent); qualification, 10 shares; remuneration (except managing director, if any), £500 per annum, divisible. Registered office, 29A, Charing Cross Road, W.C.

Frenkel's Illuminated Signs, Ltd. (109,072).—This company was registered on April 21st, with a capital of £500 in 475 preference shares of £1 each and 500 ordinary shares of 1s. each, to acquire a licence granted to L. S. Levy by the Reflector Syndicate, Ltd., and to carry on the business of manufacturers of and dealers in illuminated advertising signs, and to adopt an agreement with J. Frenkel & Co., Ltd. The subscribers (with one share each) are:—A. Jackson, Bassishaw House, Basinghall Street, E.C., gentleman; L. A. Levy, 60, Priory Road, N.W., chemist. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; qualification, £5. Registered office, Bassishaw House, Basinghall Street, E.C.

Garrett, Hunt & Co., Ltd. (108,995).—This company was registered on April 19th, with a capital of £2,000 in £1 shares (200 "A" and 1,800 "B"), to take over the business of electrical engineers and contractors carried on by C. W. Garrett and G. T. Hunt at 181, High Street, Lewisham, as Garrett, Hunt & Co. The subscribers (with one "B" share each) are:—C. H. North, 2, Plassy Road, Catford, S.E., clerk; F. F. Rowley, 35, Datchett Road, Perry Hill, Catford, S.E., clerk. Private company. The number of directors is not to be less than two or more than five; the first are C. W. Garrett, G. T. Hunt and C. J. W. Daniels. Registered office, 181, High Street, Lewisham.

Hill & Harrington, Ltd. (108,963).—This company was registered on April 18th, with a capital of £2,000 in £1 shares, to take over the business carried on at 41, Berners Street, W., as "Hill & Harrington," and to carry on the business of electrical and mechanical engineers, contractors, &c. The subscribers (with one share each) are:—W. J. King, 109, Hampton Road, Forest Gate, clerk; W. M. Grant, 14, Copthall Avenue, E.C., clerk. Private company. The number of directors is not to be less than two or more than five; the first are J. Harrington and G. R. Barham; qualification, £50; remuneration as fixed by the company. Registered office, 41, Berners Street, W.

W. F. Peare, Ltd. (3,557).—This company was registered in Dublin on April 21st, with a capital of £10,000 in £1 shares, to acquire the business of an electrical engineer carried on by W. F. Peare, Catherine Street, Waterford. The subscribers (with one share each) are:—Sir W. G. D. Goff, Glenville, Co. Waterford, baronet; W. F. Peare, Catherine Street, Waterford, motor agent. Private company. The number of directors is not to be less than two or more than four; the first are Sir W. G. D. Goff and H. W. D. Goff. Registered offices, 3, Catherine Street, Waterford.

New African Concessions Syndicate, Ltd. (109,342).—This company was registered on April 29th, with a capital of £50,007 in £1 shares, to acquire the undertaking of the African Concessions Syndicate, Ltd. (incorporated in 1895), to carry on the business as suppliers of electric light, heat and power, sinkers of wells and shafts, builders and constructors of reservoirs, waterworks, &c., and to adopt an agreement with the said old company and its liquidators. The subscribers (with one share each) are:—W. A. Wills, 701, Salisbury House, London Wall, E.C., merchant; Hon. J. R. Delays Tollemache, Counties Club, Tunbridge Wells, director; A. Scott, Palmerston House, Old Broad Street, E.C., member of Stock Exchange; J. Hall, 701, Salisbury House, London Wall, E.C., barrister; D. E. Brodie, 2, London Wall Buildings, E.C., F.C.I.S.; A. H. D. Cochrane, 62, London Wall Buildings, E.C., director; W. Praeger, Buckminster, Grantham, director. Minimum cash subscription, seven shares. The first directors are W. A. Wills, Hon. R. J. Delays Tollemache, A. H. D. Cochrane, W. Praeger and P. S. Inskipp; qualification (except first directors), £100; remuneration as fixed by the company. Registered by Hollams, Sons, Coward & Hawksley, 30, Mincing Lane, E.C.

Grindell-Matthews Wireless Telephone Syndicate, Ltd. (109,260).—This company was registered on April 27th, with a capital of £20,000 in £1 shares, to carry on the business of electricians, electrical and general engineers, manufacturers of apparatus and appliances for telephonic or telegraphic systems, and to adopt an agreement with F. Rouse, Pool & Co. The subscribers (with one share each) are:—F. E. Pitts, 62, Harborough Road, Streatham, secretary; G. H. Dunham, 102, Garthorne Road, Honor Oak Park, S.E., clerk; E. E. Hunt, 33, Helix Road, Brixton Hill, S.W., clerk; E. Sidnet, 38, Trebovir Road, Earl's Court, S.W., secretary; W. Y. Yeoman, 111, East Dulwich Grove, S.E., clerk; A. A. Amos, 45, Carysfort Road, Clissold Park, N., clerk; W. H. Walford, 239, Mortlake Road, Ilford, clerk. Minimum cash subscription, 1,000 shares. The number of directors is not to be less than three or more than seven; the first are Sir J. Clifton Robinson, Kt., J.P., 15, Cockspur Street, S.W.; Sir William Bull, Kt., M.P., 474, Uxbridge Road, W.; Sir Frederick Frankland, Bt., 3, Queen's Gardens, Windsor; F. Rouse Pool, Chry-an-Kerris, Wolseley Road, Crouch End, N.; and J. Cameron; qualification, 100 shares; remuneration, £75 each per annum (chairman £100). Registered by Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.

Harpin & Co., Ltd. (109,290).—This company was registered on April 20th, with a capital of £2,500 in £1 shares (1,500 6 per cent. cumulative preferred), to take over the business of electric lighting and power engineers, carried on by J. H. Harpin and P. T. Holloway, at Birmingham and Dudley, as John H. Harpin & Co. The subscribers (with one share each) are:—J. H. Harpin, Gordon House, Boldmere Road, Erdington, electrical engineer; P. T. Holloway, Oak Leigh, Grange Road, Dudley, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are F. C. N. Holloway, J. H. Harpin and P. T. Holloway; qualification, £50; remuneration, £15 per annum. Registered office, Bank Chambers, 47, Temple Row, Birmingham.

Charles A. Day & Co., Ltd. (109,249).—This company was registered on April 27th, with a capital of £2,000 in £1 shares (1,000 preferred), to take over the business of ironmongers and electricians carried on at 39, Mill Street, Macclesfield, as Charles A. Day & Co. The subscribers (with one share each) are:—C. A. Day, West Cottage, Macclesfield, ironmonger; Mrs. S. Day, West Cottage, Macclesfield. Private company. The number of directors is not to be less than two or more than five; the first are C. A. Day and Mrs. S. Day; qualification, 25 shares; remuneration as fixed by the company. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, E.C.

Crampton & Co., Ltd. (109,320).—This company was registered on April 29th, with a capital of £2,500 in £1 shares, to carry on the business of electricians, contractors, engineers, manufacturers of and dealers in electrical apparatus, &c. The subscribers are: W. J. Crampton, 73, Queen Victoria Street, E.C., electrician, 2,498 shares; S. Crampton, Sawston, printer, one; E. B. Crampton, 10, Queen's Terrace, St. Johns Wood, N.W., actor, one. Private company. The number of directors is not to be less two or more than three; the first are W. J. Crampton, S. Crampton and E. B. Crampton; qualification, one share. Registered by Waterlow & Sons, Ltd., London Wall, E.C.

J. H. Wallace & Co., Ltd. (109,264).—This company was registered on April 27th, with a capital of £5,000 in £1 shares, to carry on the business of hydraulic and general consulting engineers, electricians, manufacturers of and dealers in electrical and other machinery and apparatus, &c. The subscribers (with one share each) are:—F. Birch, 123, Gower Street, W.C., solicitor; F. J. White, Thornleigh, Ingrave Road, near Brentwood, clerk. Private company. The number of directors is not to be less than two or more than seven; the first are J. H. Wallace (chairman), J. F. Sickman, F. E. Greenwood, W. L. Bowker and J. Perry. Registered by Surtees, Phillpotts and Co., 4, Bishopsgate, E.C.

Diapanad, Ltd. (109 209).—This company was registered on on April 26th, with a capital of £2,000 in 1,500 preferred ordinary shares of £1 each and £2,000 deferred shares of 5s. each, to carry on the business of electrical and illuminating engineers, and to acquire and turn to account a certain invention for improvements relating to illuminated signs and indicators. The subscribers (with one preferred share each) are:—W. H. Carter, 630, High Road, Leytonstone, gentleman; A. C. Dark, 16, Cerssy Road, Hampstead, N.W., gentleman. Private company. The number of directors is not to be less than three or more than five; the subscribers are to appoint the first; qualification, £5; remuneration as fixed by the company. Registered office, 40, High Holborn, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Paignton Electric Light and Power Co., Ltd. (98,437).—Issue on April 13th of £400 debentures, part of a series of which particulars have already been filed.

Hindhead and District Electric Light Co., Ltd. (75,361).—Issues from March 7th to April 9th, 1910, of £950 debentures, part of a series of which particulars have already been filed.

Anglo-American Telegraph Co., Ltd. (2,891c).—This company's annual return, made up to February 18th, has been filed. The entire capital of £7,000,000, in £589,920 ordinary stock, £3,230,040 preferred ordinary stock and £3,230,040 deferred ordinary stock, has been taken up. £7,000,000 has been received. Mortgages and charges: Nil.

CITY NOTES.

British Westinghouse Electric and Manufacturing Co., Ltd.

The tenth annual report just issued for the year ended December 31st, 1909, states that, notwithstanding serious trade depression, accompanied by unusually severe competition, the directors are able to report an improvement in results of the year's trading over those of 1908. The trading, &c., profits amount to £84,156, from which fall to be deducted: Depreciation on machinery, plant, tools, &c., £6,481 (in addition to the £10,262 reserved for general depreciation); expenses on surplus land and buildings, £5,674; interest on 6 per cent. prior lien debentures, £14,700; interest on 4 per cent. mortgage debenture stock, £49,654 = £76,509, leaving a balance of £7,647, which balance has been absorbed by the appropriation of £5,300 required for the prior lien redemption fund, expenditure on contracts of previous years, amounting to £2,486, and by the writing off of £660 from expenses of issue of prior lien debentures, leaving a debit balance of £799. This debit balance, together with the debit balance of £6,521 brought forward from last year, making a total of £7,320, is now to be carried forward. In addition to a substantial sum appropriated out of revenue during the year for the maintenance of buildings, machinery and plant, a further amount of £16,743 has been applied to the depreciation of the same items, which sum the directors consider sufficient under the circumstances. The financial position of the company continues sound and satisfactory. While there has been a smaller output for the home market, the export business shows an appreciable improvement as compared with that of last year. The diminution in gross profit due to a reduction in volume has been more than counterbalanced by economies and increased manufacturing efficiency. Orders to date are substantially in advance of the corresponding period of last year, which the directors hope and believe is indicative of a general improvement in trade. Mr. P. A. Lange, who, as general manager of works, has done much to improve the manufacturing efficiency at Trafford Park, has been elected to a seat on the board to fill one of the existing vacancies, and the shareholders will be asked to confirm this appointment at the meeting, which is called for Monday next (May 9th) at Hamilton House, Victoria Embankment, E.C.

Elmore's German and Austro-Hungarian Metal Co., Ltd.

The directors submit the accounts of the company and those of the Metall Co. for the year ended December 31st, 1909. The only alterations in the accounts of this company are that the amount of 8 per cent. debenture stock has during the year been further reduced by the redemption of £808; that the loan of £4,000 has been repaid, and that the £8,000 of stock issued as collateral security has been cancelled. The loan to the Metall Co. now stands at £50,965. The position of the Metall Co. has improved during the year. The weight of goods sold shows an increase of 243 tons, and the company is now one of the largest, if not the largest, maker of copper tubes in Germany.

The large amount of freight which the company has now to handle, necessitated the installation of a railway siding, while the increased business required the erection of a large building for storage, as well as bunkers for coals. All these have been erected on the other side of the river, and are connected with the works by a substantial bridge. It is believed that these extensions will considerably reduce the cost of transport, and, in addition, will accelerate delivery. A powerful hydraulic push bench has also been erected, which has increased the speed in the production of the large sizes of copper tubes at a reduced cost. The whole of such extensions has been paid for without raising further capital. The home trade was not good during the year, and a large proportion of the sales was for export; the average selling price received was, therefore, less than in previous years, with the result that, notwithstanding the increased sales, the net profit is very little larger. Owing to the increased output, the cost of production has been still further reduced. The financial position of the company is improving, and the increases on bills payable and sundry creditors are due to the increased stock of copper and the larger amount due from sundry debtors. The loan from Messrs. Sal. Oppenheim, Jun., & Co. has been further reduced by M. 50,000 (say £2,500) since December 31st last, while the amount standing to the credit of reserve account has been further increased since that date, and now stands at M. 77,149.58, or £3,857.

Although the dividend receivable from the Metall Co. is 10 per cent. as against 9½ per cent. last year, the amount standing to the credit of profit and loss in the accounts of this company is not sufficient to permit of a dividend being declared upon the company's shares. Messrs. Macfarlan, Heal and Garnett have again waived £275 of their fees for the year.

Eastern Telegraph Co., Ltd.

The report of the directors for the half-year ended December 31st, 1909, states that the revenue for the period amounted to £620,942, from which are deducted £204,871 for the ordinary expenses, and £45,668 for expenditure relating to maintenance of cables, sundry differences in exchange, and income-tax payable abroad, leaving a balance of £370,403, to which is added £55,069 brought forward, making a total available balance of £425,472. After providing for income-tax payable in England, interest on mortgage debenture stock, and dividends on the preference stock, which in all absorb £81,019, there remains a balance of £344,453, out of which the directors have placed £130,000 to the general reserve fund, and have paid an interim dividend of 1¼ per cent. on the ordinary stock, amounting to £50,000. The directors now recommend the declaration of a final dividend on the ordinary stock of 1¼ per cent. and a bonus of 2 per cent., amounting together to £130,000, both payable on May 11th, free of income-tax, and making, with the three previous payments on account, a total distribution of 7 per cent. for the year ended December 31st, 1909. It is proposed to carry forward the balance of £34,453. As announced recently in the Press, this company, in combination with the associated companies, has made arrangements for the transmission of a special service of British Imperial news, available for distribution throughout the British Possessions served by the associated companies, whereby a considerable addition to the volume of Imperial news is being provided without any increase of cost to the public.

Craigpark Electric Cable Co., Ltd.

Mr. W. S. Brown presided at the seventh annual general meeting in Glasgow on Tuesday, May 3rd, and in moving the adoption of the report (see Electrical Review, page 707), explained that the company had been spending a good deal of money of late years in extending existing plant and putting down new. That expenditure was greatly necessary owing to the growth of the business, and they had anticipated that it would bear fruit this year in increased profits. Unfortunately, the rise in the price of rubber had dashed their hopes in that respect. They were now, however, in a very satisfactory position, having lost nothing in contracts through the rise in material. During the first few months of the year, owing to the appreciation in rubber, they barely made ends meet, but the latter part had brought a distinct improvement, and they were now in a very sound position. He moved the payment of a dividend at 6 per cent. on ordinary shares, and 3 per cent. on preference shares, making 6 per cent. for the year.

Prof. Maclean seconded, and the report, &c., were approved.

Mr. C. J. Maclean, in moving the re-election of Messrs. Tullis and Rentoul as directors, said that in view of the tremendous rise in the price of rubber, he expected that they would not have been able to pay a single penny of dividend. The fact that they had paid 6 per cent. reflected the greatest credit on the directors and management.

West India and Panama Telegraph Co., Ltd.

In their report for the six months ended December 31st, 1909, the directors state that the amount to credit of revenue is £34,679, against £34,872 for the corresponding half-year of 1908, and the expenses have been £23,558, against £22,160. The result is, therefore, a balance of £11,121, to which is added £1,530 interest on investments and £660 brought forward, making an available total of £13,310. The directors propose that this amount be dealt with as follows:—First preference shares, dividend of 6s. per share, six months to December 31st, £10,369; second preference shares, payment of 9s. per share on account of dividends accrued to December 31st, 1909, £2,101; balance to current half-year's account, £840. The expenses of repairing cables, charged to revenue, amount to £7,981, as compared with £6,659 for the corresponding half-year. This is exclusive of an expenditure of £2,414, which has been charged to reserve in respect of 33 knots of new cable used in the repair and partial renewal of the St. Kitts-Antigua and of the Jamaica-San Juan sections.

Wolverhampton and District Electric Tramways Co., Ltd.—The total revenue for 1909 was £22,851. After deducting expenses, debenture interest, repairs and maintenance, renewals fund account, &c., there is £262 carried forward.

Continental.—France.—La Compagnie Continentale Edison, of Paris, reports a net profit of £210,541 for the last financial year, as compared with only £168,441 in the preceding 12 months.

The balance-sheet of the Société Havraise d'Energie Electrique, of Havre, for the last financial year shows a net profit of £31,619, as compared with only £26,470 in the preceding 12 months.

Russia.—The balance-sheet of the Compagnie d'Electricité du Midi de la Russia for the last financial year shows a profit of £14,226, as compared with £17,494 in the preceding 12 months.

Greece.—The report of the Compagnie Hellenique d'Electricité, système Thomson-Houston, of Athens, for the last financial year shows a net profit of £26,920, as contrasted with £24,392 in the preceding 12 months.

City of Buenos Ayres Tramways Co., Ltd.—For the quarter ended March 31st a dividend of 1s. 3d. per share is announced.

Dudley and Stourbridge Electric Traction Co., Ltd.—The gross receipts for the year 1909 were £44,357. After paying a dividend of 2 per cent. per annum on the ordinary shares, £12 is carried forward.

Rio de Janeiro Tramways, Light and Power Co.—The Central News New York representative wires to the press stating that the Brazilian High Court of Justice has issued an injunction against the Companhia Brazileira de Energia Electrica, restraining that company from exercising a concession to use the streets of the city for the purpose of supplying electric light and power for a period of 90 years, in competition with the Rio de Janeiro Tramway, Light and Power Co., a corporation the capital of which is largely held in England. The Court holds that the latter company has the exclusive concession for the purposes mentioned

Colombo Electric Tramways and Lighting Co., Ltd.

The eighth annual general meeting of the shareholders of this company was held on Wednesday, last week, at the offices, 11, St. Benet Place, Gracechurch Street. The proceedings were not open to the Press, but we extract the following from the report of the directors:—"The directors' report for the year ended December, 1909, presents accounts showing a total net profit in Ceylon, after deducting all current expenses, amounting to £23,200. During the year, 2,019,639 units were generated as against 1,958,765, the cost per unit remaining practically the same. The tramway receipts from this source continued to show improvement. The expenditure under the head of rolling stock maintenance account showed but little variation, a further number of cars having been reconstructed during the year and charged to this account. The total number of passengers carried amounted to 7,109,939 as against 6,862,303 for the previous year. Extensions of the lighting branch still continue with satisfactory results. £5,300 has been transferred from the general reserve and renewal fund; £4,000 of this sum having been written off the track renewal account, and £1,300 off the mains and plant account. The total available profit, after providing for debenture interest and all expenses, and including the balance brought forward, amounts to £17,351. Out of this the directors have transferred £7,300 to general reserve and renewal fund, and propose to pay a dividend of 6 per cent., free of income-tax, on the share capital, amounting to £7,850, leaving £2,201 to carry forward."

Singapore Electric Tramways, Ltd.

The directors' report for the year ended December 31st, 1909, states that the accounts show an excess of revenue over expenditure of £28,512, against which has been charged debenture interest, depreciation and royalty amounting to £28,377, leaving a profit for the year of £135. As compared with 1908, the tramway revenue shows an increase of $17,194·53, the passengers carried an increase of 13,806, and the car-miles run an increase of 193,354. The passengers carried per car-mile have fallen from 6·54 in 1908 to 5·96, but up to April 16th in the present year this ratio has recovered to 6·17. Notwithstanding the increased car-mileage, the tramway working expenses show a decrease of $5,258·23. The general manager reports that trade generally in Singapore is improving, and in consequence he anticipates that the poorer classes of Chinese will use the cars more freely and that increased traffic receipts will result. The revenue from lighting and power supplies continues to increase satisfactorily, being 62 per cent. higher than in 1908 and 216 per cent. higher than in 1907. Anderson Bridge over the Singapore River was formally opened at noon on March 12th last, and the company's cars commenced running over the bridge in the afternoon of that day. An increase of traffic receipts is expected from the connection which has been made by the bridge between Sections 3 and 6. The laying of the track on the deviation of Keppel Road, necessitated by the construction of the new dock referred to in the last report, has not yet been commenced, as the new road has not settled down sufficiently to allow of permanent work upon it. The delay is of no importance, as the company will continue to run its cars along the present road until the new track is entirely completed to the satisfaction of the general manager.

Sir Frank A. Swettenham, K.C.M.G., presided on Tuesday at the offices, 19, St. Swithin Lane, over the ordinary general meeting. In moving the adoption of the above report, he said that the expenditure of the company was very fully given in the report, but there were one or two points to which he would draw their attention. Briefly, the position was that they had done better in 1909 than in 1908 by £4,176, and the amount of profit for the year viz., £135, small though it was, represented a very satisfactory advance on the result obtained in 1908, and they hoped the improvement would continue during the current year. The profit mentioned was made after paying £17,451 for debenture interest, £589 for royalties, and after writing off £10,336 for depreciation. The Singapore receipts for the year under consideration were £64,234, as against £60,020 for 1908, showing an increase of gross receipts of £4,214. It was very satisfactory to note that the ratio of working expenses to those receipts fell from 58·76 per cent. in 1908, to 52·63 per cent. in 1909, and the expenses per car-mile fell from 3·99d. to 3·56d. The total running expenses last year were £613 less than in 1908, with an increased car-mileage of 193,354 miles. They would see that they carried 13,806 more passengers than in the previous year, but the passengers carried per car-mile dropped from 6·54 to 5·96. This they believed to be due to trade depression, to which reference was made at the last meeting, but there were now signs of recovery. As stated in the report, the passengers per car-mile had increased during the present year, although the 1908 figure of 6·54 had not yet been reached. If, however, they took the three months ending Saturday last, they found the average number of passengers per car-mile was 6·27, as against 6·17 for the first 16 weeks of that year. He had referred to the point in some detail, because they hoped that the increased car-mileage now being run would be justified by the maintenance of the number of passengers carried over each car-mile. The receipts for the sale of electric energy to the Government and the municipality of Singapore for light and power continued satisfactory, and the increase in 1909 over 1908 amounted to the substantial sum of £2,262, or an increase of 62 per cent. He was glad to be able to report that the new bridge over the Singapore River was opened on March 12th last, and the company's cars commenced running over the bridge on that day. It was too soon yet to say to what extent they were benefited by the opening of the bridge, which connected two sections of the tramway undertaking, but for the 13 weeks to April 30th the receipts were £15,378, as compared with £14,530, or an increase of £848. The directors considered that the larger proportion of the increase was due to improved trade conditions in Singapore, but what was not attributable to that cause might be regarded as due to the extra use of the tramways since the opening of the bridge on March 12th. In previous years the comparatively large sums paid for ticket checking and inspection gave rise to comment, but in 1909 this service cost £319 less than in the previous year. The actual expense of inspection, as distinct from the cost of tickets and the wages of the ticket collectors of the company, was about £2,900. The board took the opportunity of discussing this matter very fully with the general manager when he was in this country last year, and they did not at present see their way to reduce the expenditure at present without running very serious risk, and their Singapore agents had advised them in the same sense.

Sir Charles Petrie seconded the report, and the motion was adopted.

The retiring directors were also re-elected.

West African Telegraph Co., Ltd.—The directors' report for the year ended December 31st, 1909, states that the revenue amounted to £59,099, from which is deducted £15,737 for the ordinary expenses, and £6,521 for expenditure relating to maintenance of cables and income-tax abroad, leaving a balance of £36,841, plus £1,731 brought forward, making a total available balance of £38,573. The sum of £1,407 has been provided for income-tax, £27,000 has been transferred to general reserve fund, and an interim dividend of 2 per cent. (free of income-tax), absorbing £4,622, was paid on December 1st last. The directors recommend a final dividend of 2 per cent. (free of income-tax), on and after May 12th, making, with the interim distribution, 4 per cent. for the year, the balance of £922 being carried forward.

German South American Telegraph Co.—A special despatch from Berlin to the *Financial News* states that from August 26th to December 31st, 1909, this company realised a net profit of M. 189,623, and will pay a dividend of 6 per cent. The cable of the company has been working only between Borkum and Teneriffe. The second portion of the cable—from Teneriffe to Monrovia—was opened a few weeks ago, and the final portion—from Monrovia to Pernambuco—will be finished in May, 1911. The cost of construction has been covered by the issue of M. 6,000,000 of new shares and M. 9,850,000 of 4½ per cent. debentures.

Western Telegraph Co., Ltd.—The report states that the revenue for the half-year to December 31st amounted to £391,504, and the working expenses to £141,022. After providing £16,000 for debenture stock interest and £7,558 for income-tax, there remains £226 923, plus £6,463 brought forward, making a total of £233,387. First and second interim dividends, amounting to £62,379, have been paid, and, after transferring £155,000 to the general reserve fund, and £10,000 to the land and buildings depreciation fund, there remains £6,008, which is carried forward. The cable between Ascension and Buenos Ayres has been successfully completed, and will be opened for traffic this month.

West Coast of America Telegraph Co., Ltd.—The directors state that for the year ended December 31st last the gross receipts amounted to £50,416, as against £52,612 in 1908. The working expenses were £39,204, as compared with £33,193 for the previous year. After providing £6,000 for the interest on the 4 per cent. debentures, £800 for the interest on the 4 per cent. income bonds, and £614 for income-tax, there remains a balance of £3,797, plus £629 brought forward, making a total of £4,426. Of this amount £1,000 has been placed to the general reserve fund, and the directors recommend the payment of a dividend of 2½ per cent., free of income-tax, amounting to £2,813, leaving £613 to be carried forward. The company's old cable repairing steamer *Retriever* has been sold, and replaced by a new vessel which bears the same name.

Wemyss and District Tramways Co.—The annual meeting was recently held at Leven, Mr. Joseph Bridge presiding. The directors' report showed that for the year the traffic receipts amounted to £13,658, a slight decrease on the previous year. The ordinary expenditure on repairs and maintenance and operating expenses was, however, considerably reduced. The balance at the credit of the profit and loss account was £2,599. From the profits for the year, and the amount brought forward from the previous year, the 6 per cent. dividend on the preference shares had been paid, and also the sum of £200 to the trustees for the mortgage debenture stockholders. The directors recommended a dividend of 6 per cent. on the ordinary shares. The report was adopted.

Trafford Park Light and Power Co., Ltd.—The report of this company, which appeared on page 658 of our issue of April 22nd, was, it should be noted, for the year ended March, "1909." That for 1910 is not yet issued. The 1909 report came to hand for our guidance in preparing our annual statistics of electricity works, but it was published in our "City Notes" inadvertently, under the impression that it had just been issued from the printers.

Electric Supply Corporation, Ltd.

The directors' report for the year ended December, 31st, 1909, states that the gross earnings amounted to £83,801, which is an increase of £2,561, whilst the sum taken into net revenue account for the same period amounts to £9,300, made up as to £8,834 from the company's working, and as to £466 from dividends on its holding in the Dumbarton Tramways Co. preference shares, as compared with £6,566 made up as to £6,335 and £230 respectively, as shown in the directors' report for 1908. After paying interest upon debenture stock and temporary loans there remains a surplus of £3,780, as against £2,397 in 1908.

The following table shows the progress made by the company:—

Year.	Equivalent in 8-c.p. lamps connected.	Units sold.	Gross earnings.	Profit, including investments.
1907	81,554	1,183,564	£16,741	£5,456
1908	97,778	2,034,087	21,240	6,566
1909	113,699	2,492,416	23,801	9,300

The company received full dividends upon its Dumbarton Burgh and County Tramways Co., Ltd., 6 per cent. preference shares, and the directors are pleased to again report that continued and excellent progress has been made during the year by the Hendon Electric Supply Co., Ltd., the total number of lamps taking supply at December 31st last being rather over 23,000, compared with 12,600 in the previous year. The directors announce with regret that Major Heaton-Ellis has retired from the board of directors. With a view to economy, the directors have not filled the seat thus vacated. They have also agreed to accept reduced fees during the current year.

	Lamps connected. (Equivalent in 8 c.p.)		
	1908.	1909.	Increase.
Chelmsford	26,693	28,058	1,365
Jedburgh	3,347	3,380	33
Melrose	3,397	3,823	426
Dalkeith	4,952	6,008	1,056
Dollar	1,821	1,969	148
Totnes	3,262	3,712	450
Exmouth	9,096	10,238	1,142
St. Andrews	13,437	16,647	3,210
Hitchin	6,226	6,740	514
Dumbarton	19,547	24,178	4,631
Falmouth	6,510	9,456	2,946
	97,778	113,699	15,921

Oriental Telephone and Electric Co., Ltd.

Mr. B. St. John Ackers presided on Wednesday of last week, over the sixteenth ordinary general meeting of this company, held in the Abercorn Rooms, Great Eastern Hotel, London.

The Chairman, in moving the adoption of the report (see Electrical Review, page 660), said that the board were pleased to be able to present a favourable report of the results of the company's affairs for the past year. Whilst they thought it wise to be content to continue to pay an 8 per cent. dividend, they had made substantial increases to both reserve and the amount carried forward, and it was in that direction that the progress of the past year was indicated. There could be no doubt that the sums set aside from time to time had been most usefully employed in the business, and had largely helped in placing the company in its present strong position, by assisting the development of their revenues in the various centres without having to rely solely on their share and debenture capital. This development continued to go steadily forward, and the prospects were encouraging. Both the share and debenture capital were very moderate, but the directors would not hesitate to take advantage of any promising opportunities which might present themselves to add to the importance and usefulness of the company, both to the Governments and the public of the countries which it served, and come before the shareholders with any plans they might have in connection therewith. Steady development was also apparent in their subsidiary companies, one of which, the Bombay Co., paid a higher dividend for the year 1909. The Bengal Co. would also have been justified in increasing its dividend but for having had to face a further pressing demand for opening up fresh districts to the north and south of Calcutta, requiring further large outlays towards which some of their surplus profits were being applied. The negotiations between that company and the Indian Government for taking over the latter's telephone system, were occupying the board's attention, and they entertained every hope that they would lead to a satisfactory result by which the Bengal Co.'s position would not only be further strengthened but their general revenues benefited. To secure this object the company had undertaken to lend their financial assistance as far as possible, and their interest in the Bengal Co. might therefore become second only to that they owned at present in the Telephone Co. of Egypt. In Egypt the progress did not equal, in proportion, that made during the years immediately preceding the recent crisis, from the effects of which that country had not as yet entirely recovered. Nevertheless, a satisfactory increase in revenue had been recorded during the year, and had continued since, according to their latest advices. The China and Japan Co. was again able to report satisfactory developments at Hong Kong, and that company was husbanding its resources with a view to meeting such expenditure as it might be called upon to make in the near future for the extension and consolidation of its interests. The progress made by their branch in Kowloon was equally marked. The railway from that place to Canton, which had been under construction during several years past by English engineers and with English capital, was now reported to have been completed, and would be ready for traffic in July next. This would render Kowloon a place of great importance, and the China Co. expected to derive very considerable benefits from the increased commercial activity which was by general assent anticipated. The negotiations which the directors had carried on for a considerable time with the Government of Mauritius for the purpose of extending telephone facilities as far as practicable all over the island, have now been nearly concluded, and a final settlement of that question was likely to be reached within the next few months. The expenditure involved would, however, be moderate.

Mr. Thos. Lloyd seconded the motion.

The Chairman, replying to observations made by some of the shareholders, said that as to increasing the dividend, the directors felt that it was better to pay a steady dividend of 8 per cent. year by year, than a high one one year, and a drop the next. The policy of the board was to build up a reserve so as to ensure a steady dividend. They did not say it would never be increased—they believed it would—but for the present, considering the large sums which they would in all probability have to spend for the purpose of increasing the prosperity of the company, and enlarging its sphere of operations, the board thought it was wiser to keep to the steady 8 per cent. With regard to the phrase in the auditors' report as to the value of the shares in the subsidiary companies, perhaps that required a little explanation. The board had endeavoured, as far as it was possible, not to keep changing the value year by year, according to fluctuations occasioned by local circumstances. As a matter of fact, the shares in the Bengal Co., which stood at 80 some time ago, were now standing at par. Therefore they were not below what was stated in the report. Again, the Bombay shares of £25 stood at £32. They would therefore see that the value, as stated in the accounts, was, if anything, below their actual value. Of course, they could not tell—nobody could tell—what would be the case if a very large quantity of shares were put on to the market. As to the question of opening up one of the places in the Straits Settlements, the board were always looking out for fresh fields to develop, and as soon as they could see that any money spent would show at least a fair return, they were willing to welcome any extension of the business. They were, however, very careful not to embark on anything of a speculative character.

The report was adopted.

Cuba Submarine Telegraph Co., Ltd.

Mr. Geo. Keith presided on Wednesday last week over the seventy-seventh ordinary general meeting of the above company, held at 58, Old Broad Street, E.C. In moving the adoption of the report (see Electrical Review, page 659), he reminded the shareholders that the results of the period under review—July to December—mainly depended upon the weather. They would, therefore, be pleased to see that the accounts for that period compared very favourably on the whole with those of the same period in 1908. The improvement shown might be attributed partly to a more active state of business following the good harvest, and partly to Press and other traffic caused by the exceptional floods which had taken place in Cuba and the West Indies. The bad weather in Cuba interfered with the working of the land lines, especially in the western portion of the islands, and led to a much larger use of the cables along the southern coast for local traffic. The gross traffic receipts were £16,376, or £1,518 more than in 1908. On the debit side the London expenses remained about the same, but the expenses at the station were £278 more. Altogether the total expenses amounted to £6,415, or £389 more than they were in 1908. The result of the year's business was that they had a profit of £9,961. They had put £2,000 to the reserve fund and provided £3,000 for the payment of a dividend on the preference shares which would absorb £3,000, and they proposed to pay the usual dividend at the rate of 6 per cent. on the ordinary shares free of income-tax. They further increased the carry forward by £161 to £7,220. So long as they were able to accomplish such satisfactory things in the dull and wet period of the year, he thought it would be admitted that they would be pursuing a sane and sound policy. The shareholders had, however, to remember that they had some 1,200 miles of cable under their care, and they had, therefore, to provide a sufficient reserve so that it should not be unduly reduced, or its recuperative power taken away whenever a demand was made upon it. As regarded the present year the business was generally active. There were a number of Government and private works on hand which should all be reflected in the revenue of that company. He was sure they would be pleased to know that the current year was proving to be satisfactory.

Mr. Charles W. Parish seconded the motion, and the report was adopted.

Telephone Manufacturing Profits.—The L. M. Ericsson Co., probably the largest manufacturers of telephones in Europe, are apparently doing an excellent business. Owing to the great number of orders that are continually being received from all parts of the world, they have been obliged to considerably enlarge their works. The net profits of this company for 1909, after deducting all expenses, were £62,800. It proposed to pay the shareholders a bonus of £41,555, or about £6 per share, and place about £21,233 to the reserve fund.

Indo-European Telegraph Co., Ltd.

The meeting of this company was held on Wednesday last week at 18, Old Broad Street, E.C., Mr. J. Herbert Tritton presiding.

In proposing the adoption of the report (see Electrical Review, p. 611), the Chairman said that the year under review had been an uneventful one. Persia had reverted to a more or less normal condition from the telegraph point of view, and the lines over the great portions of the Continents of Europe and Asia traversed by the company's system had been subject to even less interruption than in former years. Strange to say, their troubles this year had been nearer home. The difficulty of the interruption of submarine cables owing to damage done by the trawls of the fishing fleets around the coasts of Great Britain, was one that had seriously affected most of the companies having cables touching these shores. It was, of course, a serious difficulty, but one that certainly called for solution. In these days, when the merchant entrusted the safety of his argosies, and even, perhaps, his commercial credit to the difference between a Morse dot and a dash over many thousands of miles of wire, telegraph communications must be not only the best that could be given, but must be, as far as possible, completely secured against extraneous risks of all kinds. Both the cables across the North Sea, in which the company had leased wires, were totally interrupted, the one for 79 days and the other for 66 days, of which 49 days were concurrent. The effect of this on the company's business might well be imagined, particularly as the Postmaster-General found himself unable, owing to the requirements of his own traffic, to give them the use of relief wires, except for a very small portion of the time. Under the above circumstances the directors had been forced to look for additional cable accommodation between England and Germany, if possible in a direction removed from fishing operations, if such was to be found. Whilst tariffs showed a consistent tendency to fall, he was pleased to say that traffics had shown a gratifying rise during the year. There was only one way to deal with increasing traffics, and that was the attainment and maintenance of perfect methods of transmission with the highest class obtainable of instruments and apparatus of all kinds. They could say that they had no fear of reproach on the above grounds. The managing director was continually at work on the development and improvement of the system, but there was a limit even to his ingenuity, and they were faced with the necessity of permanently increasing their carrying capacity all through their system, with attendant expense. The directors had set aside out of profits for the year a sum of £15,000 towards the cost of the additional land wire found necessary, and hoped to provide a considerable further amount for the same purpose out of profits for the coming year. The cost of additional cable accommodation was, of course, a much heavier one, and the question was still engaging the attention of the directors. He had often congratulated the shareholders on the financial position of the company. Its large liquid assets enabled the directors to meet at a moment's notice commitments such as those which might, ordinarily speaking, be almost heavy enough to necessitate the raising of fresh capital. The daily direct working between London and Karachi was of the greatest assistance in dealing rapidly and accurately with the traffic, and the directors were constantly endeavouring to better the company's own reputation in this respect. Yet they could not keep pace with the demands of their customers, who expected their code words to be carried 7,000 miles to India without the failure of a single letter, the failure of one letter only having apparently the most disastrous results upon the sense of their telegram. This carried them back to the vexed question of pronounceable, or, rather, unpronounceable, combinations. No improvement was visible in the construction of these codes, in fact, merchants, in their endeavour to condense even a complete order into the limits of one code word, were forced into combinations of letters which practically made correct transmission a matter of the utmost difficulty. True, the telegraph clerk had adapted himself wonderfully to the appalling difficulty of following for hours at a time with eye and pencil the meaningless sequence of letters, mostly consonants, and double ones at that, but the practical effect on the working, as a whole, was that their lines, and others doubtless also, were choked with telegrams of repetition, which in their case amounted to 40 per cent. of the original telegrams transmitted. Many of these repetitions were in respect of an error of one single letter. The merchant complained of damage sustained by the resulting delay to his telegram, as well as of the errors in single letters, but surely he expected too much of the telegraph service for the price he was prepared to pay. At all events, they thought that he was defeating his own object by the abuse of the pronounceable combination system. It was sincerely to be hoped that the International Committee provided for the censorship of codes submitted to it, might be the means of standardising pronounceable-combination codes on a more reasonable basis. Turning to the accounts, the revenue from message receipts and other sources showed a satisfactory increase of £12,767. The combined commercial and maintenance expenses showed an increase of £2,562, due to an item of expenditure on maintenance account of a non-recurring nature. The directors proposed the usual final dividend which absorbed £14,875, and the bonus of 20s. per share, which accounted for a further £17,000, and had again decided to recommend a special distribution out of interest upon certain investments and advance accounts of 15s. per share, free of tax in each case. There remained a sufficient surplus to enable the directors to propose the allocation of £15,000 towards the cost of increasing the carrying capacity of the system (which would, of course, ultimately amount to a considerably larger sum), and of a further sum of £5,000 to the trustees of the Retirement Trust Fund, carrying forward £7,978 to the credit of 1910. With regard to their prospects for 1910, traffics had for the months up to date been quite unprecedented, so that provided their business was not dislocated by channel cable interruptions, or any of those bolts from the blue to which undertakings such as theirs were at all times exposed, they might hope for a prosperous outcome of the year 1910.

Mr. Charles Holland seconded the resolution, and the report was unanimously agreed to.

Brisbane Electric Tramways Investment Co., Ltd.

On Wednesday of last week the annual general meeting was held at Winchester House, E.C. Mr. H. R. Beeton, in moving the adoption of the report, which was summarised in our issue of April 15th, referred to the death of Sir Malcolm McEacharn, the late chairman. Dealing with the report, he said he was glad to say that the anticipations of continued prosperity, upon which he ventured last year, had been fulfilled. Owing to the progress of Queensland which had been fortunate in a succession of good harvests, they could again congratulate themselves upon the year's result which had surpassed any in the company's history. The total receipts for 1909 amounted to £199,335, which showed an increase of £20,733 over those of the previous year. On the other hand, the expenses had increased by £8,326, so that there was an increase in the net profits of £12,407. A further sum of £18,000 had been placed to renewals, and another £1,000 would be put aside to the Accident Assurance Fund bringing the total of that item up to £3,000. The balance of net profits after the payment of interest on the debenture stock, interest and preference share dividend enabled them to recommend a balance dividend on the ordinary share of 4s. 6d. per share, free of income-tax, making with the interim dividend of 3s. 6d. per share paid to November, a total dividend of 8 per cent. on the ordinary shares for the year. The aggregate of renewals and reserves funds and undivided profits would then amount to £96,390. Their profits had been considerably added to by the celebration in Brisbane of the fiftieth anniversary of the birth of Queensland as a separate State. The total receipts for the month of August, which was the period during which the celebrations were carried out, were £22,420, being an average of 18·18d. per car-mile run, which was by far the highest average for any month on record. They did not have a single accident or adverse incident whilst dealing with that extra traffic. With regard to the car-mile receipts generally, they averaged 13·6d. for the first six months and 15·03d. for the second six months, which was an increase of 1·3d. and 2·05d. per car-mile respectively over the corresponding periods of the previous year. The proceeds of the sale of power had increased by £1,008, and there was every prospect of considerable extension in that branch of their business. There had been a slight all-round increase in nearly every item entering into tramway operation due largely to the effect of the Wages Board Act. The bulk of their increased expenditure was, however, due to their increased wages bill, consequent upon the "determination" of the Wages Board, which was gazetted June 16th last, and came into force on July 1st last. The proposed establishment of the Wages Board, to which he referred last year, had become an accomplished fact, and the result had been that there had been an increase of upwards of 15 per cent. over the corresponding period in the previous year, and that notwithstanding a slightly reduced mileage run. As to the current year, the receipts for the first quarter showed an increase of £5,704, with average car-mile receipts of 14·93d., which was almost equal to the result of the last six months of 1909, which included the extraordinary Jubilee and Exhibition traffic. The public in Brisbane had been urging the company for some time past to construct certain extensions of the system, and the directors had made proposals to the local authority on the matter. If those proposals were accepted, they would, in due course, call the shareholders together to raise the necessary capital. The company's relations with the Government and the local authorities continued to be satisfactory, and they had no reason to apprehend any abatement in the measure of prosperity which they were at present enjoying.

Mr. J. B. Concanon seconded the motion, and after a short discussion, the report was adopted.

Result of the working of the tramways as shown by the audited accounts of the original company for the year ending December 31st, 1909:—Total receipts £199,263, total expenditure £105,082, leaving net profit for year £94,181, plus £842 brought forward, leaving a balance of profit available of £95,023, which has been appropriated by the tramways company in the following manner:—To credit of a fund for renewals (bringing it up to £75,000) £18,000, dividends on shares (including income-tax) £75,000, carrying forward £2,023.

Greenock and Port Glasgow Tramways Co.—In the annual report just issued, the increase of traffic over the previous year is stated to be 6 per cent., the number of passengers carried being 6,349,638. The total revenue was £29 440, an increase of £1,703, while the working expenses were £1,361 less than in 1908. There is an available balance of £7,085, which the directors propose should be applied as follows:—To reserve fund for loan redemption, £1,769 14s.; to dividend at the rate of 5 per cent. per annum on the preference shares, £3,500; to dividend at the rate of 10 per cent. on the ordinary shares, £1,150; balance to be carried forward, £666.

Canada.—According to a dispatch to the *Standard* from Toronto the Government's loan of $3,500,000 for the purposes of the hydro-electric transmission line has been fully subscribed. The bonds are to be placed on the lists and quoted on the Toronto Stock Exchange.

Auckland Electric Tramway Co., Ltd.

The twelfth ordinary general meeting of the above company was held on Monday, at the Electrical Federation Offices, Kingsway, Mr. C. G. Tegetmeir presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, page 709), said that the results of the past year were no exception to the satisfactory accounts they had been accustomed to since the commencement of the undertaking. In alluding to the accounts, he said that the depreciation account now stood at £40,737, a net increase for the year of £6,423. That account was created for the purpose of providing for future expenditure upon renewals and reconstruction, as distinguished from the ordinary expenditure upon repairs and maintenance, which was charged to the current year's revenue. Last year the expenditure of that nature amounted to £8,576, which amount was charged to the depreciation account. In the present year the amount spent on renewals and reconstruction was £10,594. Out of the profits last year they had set aside to the depreciation account £15,000, as compared with £12,500 in the previous year. The expenditure upon renewals and reconstructions would vary from year to year, but they had now over 22 route miles of track, and they had to look forward to the time when extensive reconstructions of their permanent way would become necessary, and they considered it necessary that out of their profits from year to year they should build up an adequate fund to meet the expenditure when the need arose, so as to remove any question of doubt as to the maintenance of the dividend at the present rate, or possibly at some higher rate. The larger portion of the additional capital expenditure was on extensions to their power station and distributing system, which was commenced early in the year. The new 600-kw. set that had been installed during the year brought the total capacity of their plant up to 2,725 kw. When the whole of the work now in hand was completed, which it would be very shortly, their arrangements for generation and distribution would be most complete and up to date, and should conduce to economy in working expenses. The expenditure also included the enlargement of their two car-sheds and their repair shops, and the cost of the five new cars which they had added to their stock during the year. Early in the year they decided to purchase eight more cars, which were now in course of construction. That would bring their total number of cars up to 100, and represented an increase of 40 during the last three years at an approximate cost of £50,000. The receipts per mile of track came to £8,089 per annum, which, he thought, compared very favourably with the results obtained in large centres of population. A good portion of the increase in the traffics was due to the fact that during last year the whole of their present system of 22 miles was in operation for the whole of the year, whereas in the previous year the Mount Eagle extensions were only open for traffic during a portion of the year. It was very satisfactory to find that the extensions they had recently constructed in the suburban districts were returning the same proportionate revenue as the older portions of the system. The population of Auckland, which was now approaching 100,000, had shown marked growth during recent years, and there were many indications that the city, and New Zealand generally, were at present enjoying a very high measure of prosperity. The working expenses were £11,000 more. Power and running expenses, £67,732, showed an increase of £6,434. A good deal of that increase was due to the increased car-mileage, but to a very large extent it was accounted for by the higher scale of wages that they had been paying to their men during the greater portion of the year. The pay of their motormen ranged from 1s. to 1s. 1½d. per hour, and of conductors from 10½d. to 1s., which was probably more than double what prevailed in this country. That high standard of earnings of the working class community was a distinctive characteristic of New Zealand social conditions. With a high protective tariff no doubt their standard of expenditure was correspondingly high, but whether that was so or not, it was unquestionably the case that the material welfare of the worker in New Zealand was far in advance of anything we were accustomed to in this country. He might spend more, but he received more, and he had a larger margin over and above his expenditure upon absolute necessities which enabled him to indulge freely in the comparative luxury of tramway travelling. Repairs and maintenance had cost £30,153, being an increase of £4,073. While every economy was observed in that important item of expenditure, the first essential was to maintain their undertaking in a condition of efficiency. Of the total, £17,000 was spent upon their cars, and it was only to be expected that as the cars grew older and more work had been taken out of them, it would take more to replace the inevitable effects of wear and tear. He hoped, however, that their expenditure on repairs and maintenance had reached its maximum, but he did not think it would be found capable of any very great reduction. Administration and and general expenses showed a decrease of £804, although they had paid £958 more in rates and taxes. Insurance was £936 less, due principally to a lessened premium in respect of third party risks. They participated in a scheme for mutual insurance of third party accidents which was established some years ago by the many companies which were joined for the purpose of mutual benefit in the British Electrical Federation. The operations of the insurance scheme had been very successful, and had led to considerable savings. They obtained full and complete cover against all risks, and the cost to them last year was the exceedingly low premium of £1 7s. 3d. per cent. upon their traffic receipts. The percentage of profits payable to the Auckland City Council amounted to £3,992. During the seven years during which the company had been carrying on its operations, the total sum accruing to the Auckland City Council, out of their profits, had amounted to over £22,000. The net working profits showed an increase of £5,946. They had paid £1,076 more in debenture interest, and they had placed £2,500 more to depreciation account. They recommended that £11,500 should be placed to the reserve fund, bringing it up to £44,000. The results, satisfactory as they were, were the more satisfactory when it was borne in mind that the £50,000 of new capital issued during the year and in respect of which they were paying a full year's dividend, was in no way remunerative during the year. As to the future, the traffic receipts to date showed the substantial increase of £3,326 over those of last year, and the outlook for the present year and for the future was exceptionally promising. He wished, in conclusion, to express the board's appreciation of the services of the local directors and of the general manager. The successful working of the undertaking depended in a very great measure upon the men on the spot, and it was a matter for satisfaction that the company was well served by those he had mentioned and by a loyal and efficient staff.

Mr. C. Shibreff Hilton seconded the motion, and the report was adopted.

Lisbon Electric Tramways, Ltd.

The meeting of this company was held on Wednesday at the offices, 1, London Wall Buildings, E.C., Col. Sir Charles Euan-Smith, K.C.B., presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, April 22nd), said that the company had now completed its first decade, and from the first year of its existence until now, its operations had shown a steady and continuous improvement—an improvement which, he was pleased to say, had been more than maintained during the past year. The absence of any disturbing elements in the political arena during the past year had had a beneficial effect on business generally, and the increased prosperity of the company's tramways reflected the improved state of affairs throughout the country. The company had carried 47,995,076 passengers, earning £301,426 15s. 3d., as against 45,990,000 passengers, earning £290,199 in the previous year. Those figures spoke for themselves, and needed no comment from him, but it might interest them to know that the company's rolling stock and equipment generally were fully equal to all the calls made upon them, being kept in a high state of efficiency. The rate of exchange had remained at about the same level as in 1908. The board, in addition to making the usual reserves for exchange and depreciation, had set aside £5,000 to form the nucleus of a pension fund for the employés of the company. The directors had given much thought and attention to that matter during the past few years, their wish being to establish a fund which would, of course, be supported by contributions from the company, as well as by those who were to participate in its benefits. The great difficulty had been the getting of a capital sum to start with, which was necessary if the fund was to be established on a sound and permanent basis, and on a scale of contributions that was likely to appeal to the majority of the employés. In setting this amount aside, the directors considered that they had taken the first step towards setting up a scheme which they firmly believed the employés would thoroughly appreciate. During the year an issue of 3,310 ordinary shares had been made, which were utilised in the purchase of a further interest in the "Nova Companhia dos Ascensores Mechanicos de Lisboa." The general manager in Lisbon had been engaged in preliminary work for the conversion to electricity of the most important section of the line, and as soon as consent had been obtained from the Government and from the municipality, it would be rapidly proceeded with, and when completed it was hoped that the electrification would greatly improve the company's earning power, and also add to the comfort and facilities of the travelling public. On October 12th last year the directors paid an interim dividend of 2½ per cent. on the ordinary shares, free of income-tax, and they now recommend the payment of a final dividend of 3 per cent., also free of tax, making 5½ per cent. for the year. He was glad, in conclusion, to be able to state that the company's tramways maintained their great popularity with the general public of Lisbon under the able management of Mr. Clarke, their general manager, to whom and to the whole staff the cordial thanks of the board were due.

Mr. Ludwig Breitmeyer seconded the motion, and the report was adopted.

Submarine Cables Trust.—The report for the year ended April 15th last, states that the revenue was £25,259; the expenses were £1,160, leaving a balance of £24,099, plus £228 brought forward, making an available balance of £24,328. After providing £17,952 to meet payment of the coupons, £6,201 has been transferred to the redemption fund, leaving £175 to be carried forward. During the year 52 certificates were redeemed by purchase in the open market, with the surplus funds of the trust, costing £6,201, as above; £11,000 Anglo-American Telegraph Co.'s preferred stock have been sold during the year, the proceeds having been invested in shares of the Great Northern and Western Telegraph Companies.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be quoted in the Official List: Para Electric Railways and Lighting Co.—70,000 ordinary shares of £5 each, fully paid, Nos. 1 to 70,000; 14,000 6 per cent. cumulative preference shares of £5 each, fully paid, Nos. 115,001 to 129,000; and £700,000 5 per cent. first debenture stock (renewed special application).

River Plate Electricity Co., Ltd.

In their report for the year ended December, 1909, the directors state that the revenue account after providing for all administration expenses and depreciation on fixed plant, amounts to £37,342. Interest on the 5 per cent. debenture stock of the company requires £10,000, leaving a surplus of £27,342 plus £5,624 brought forward, making £32,966. The dividend of 6 per cent. on the preference shares absorbed £6,000; interest (6 per cent.) upon the instalments paid on the partly paid preference shares, £342; a dividend of 9 per cent. for the year upon the ordinary shares, £10,800; while there has been added to general reserve £10,000; further remuneration to the directors amounted to £684; leaving to be carried forward £5,141. The foregoing addition to the general reserve will increase that fund to £30,000. A contract for a term of years has been made with the La Plata Electric Tramways Co., Ltd., for the supply of all the power required on that company's tramway system now in course of construction. The first section of the tramway was opened early in January, 1910, and it is expected that the remaining sections will be in service in the course of the year. The board have to report a steady and continuous growth of business, both at La Plata and Tucuman. The further business offering and the necessity of maintaining the existing services at a high state of efficiency, have required the board to make immediate provision for a large extension of their generating plant and installations in the city of La Plata and the Port of Ensenada. With this view they have acquired a suitable riverside site in Ensenada upon which a supplemental generating station is being erected. This station will be equipped with two 1,500-KW. steam-turbo alternators, and it is anticipated it will be in service in time for the lighting season in 1911. The progress at Tucuman has also necessitated the provision of additional plant and mains. The first payment on account of the amortisation of the obligations of the German Trans-Oceanic Electric Co., viz., £1,600, was made on April 1st, 1909, reducing the amount outstanding and held by this company to £148,400. A further 25,000 £1 6 per cent. preference shares have been issued during the year and fully subscribed.

The seventh annual general meeting was held on Monday, April 25th, at 62, New Broad Street, E.C., Mr. M. W. Mattinson, K.C., presiding.

The CHAIRMAN, in moving the adoption of the above report, said he thought they would all be of opinion that the accounts were eminently satisfactory. The net profit of £27,342 was £5,529 better than last year. This was the seventh year of the company, and this year, like all its predecessors, represented an improvement upon the preceding year. They had a record of continuous unbroken progress in the matter of net profits. The first year, 1903, the net profits were £8,826; in 1904, £10,436; 1905, £11,879; 1906, £12,018; 1907, £17,290; 1908, £21,813; and last year, as he had already said, they were £27,342. So far as the current year was concerned, they had the approximate net profits for the first three months, and they showed a substantial improvement upon the corresponding three months of the year 1909. Unless something unforeseen happened, this year would continue the record of past years, and at the next meeting he might be able to congratulate them upon a record profit. Their profits were derived under two heads—one, the interest upon their investments, in which respect they might be said to be a trust company; the other was the net profits upon the two electric lighting stations which they ran. The interest on investments last year amounted to £9,663, which was within a few pounds of the revenue from the same source in the previous year. Their income from investments came from practically two sources—the first, and largest item, was the interest they received upon the 5 per cent. obligations of the German Trans-Oceanic Electric Co. of Buenos Ayres. That, last year amounted to £7,440, as compared with £7,500 the year before, or a reduction of £60. That was due to the fact that the amortisation of those German bonds began last year, and in April £1,600 was paid off. Under the original contract the amortisation was spread over a long term of years, ending in 1943, and would proceed on a progressive scale. The question of the amortisation of these bonds was a matter of little importance to them, as the security for them was perfect. The next main item of interest was the dividend they received upon their holding in the Rosario Electric Light Co. Last year they received £2,223, as compared with £2,173 in the preceding 12 months. Since the close of their financial year a transaction had taken place with the Rosario Co., which invested with special interest their holding in the concern. Some of the shareholders might be aware that the Rosario Electric Light Co. had given an option to a powerful Belgian syndicate of financiers to purchase the whole undertaking at a price, which, after paying the prior obligations of the company, would give a premium of somewhere about £4 a share in respect of each ordinary share. He could not say whether the option would be exercised—the probability was that it would be; but he did not think it was a matter of much moment to them. The Rosario Co. was a prosperous concern, and he was not at all sure that it would not be very much more to their interest if the option were dropped, instead of being exercised. Therefore, they regarded the question as to whether the option was exercised or not with perfect equanimity. They held 4,400 ordinary shares of £5 each, which formed part of the original ordinary capital of 12,000 shares of £5 each; so that they had got rather more than one-third of the original capital. At the time they received those shares they were looked upon as of little or no value, and they were entered in their books at a somewhat nominal figure, at which they had remained. Subsequently they acquired 500 more ordinary shares of £5 each, for which they subscribed in the ordinary way. A few months ago when the company, in connection with their extensions at Rosario, issued further ordinary capital, they subscribed for the full proportion to which they were entitled, thereby they became possessed of a further 1,250 ordinary shares of £5 each, upon which only £1 each had been paid. The net result was that they possessed 6,150 ordinary shares all told, and if the Belgian option was exercised, they would get in respect of their holding something in excess of £50,000. Obviously that would be a large capital profit, the allocation of which would have to be considered on a future occasion. If their shares were sold it would not affect their interest for the current year, as one of the terms of the sale was that the interest was to be paid down to June of this year. Coming to the principal source of their revenue, the profits derived from their two stations at La Plata and Tucuman, he was glad to say that the net revenue, subject to depreciation of fixed plant, was £35,323, as against £28,476 in the previous year, an improvement of £6,847. From that they deducted depreciation on fixed plant, and sundry other depreciations deducted at an earlier stage amounting to £5,429, as compared with £4,427 the previous year, and when that deduction was made, they had a net improvement at the stations of £5,845 That improvement was due merely to what he might call the normal growth of the stations. There had been no windfalls in the past year, and the income was not due to any abnormal circumstances. Last year he went out to the Argentine, and visited their station at Tucuman. They had an excellent station there, which, when he visited it, was working to its fullest capacity. They had a powerful competitor there in a native company, which did the public lighting and which ran the local trams and also which did a certain amount of private lighting. Their company, however, did the greater portion of the private lighting. The business was extending, with the result that they were now putting in new generating plant and mains to meet the demands which, if they did not supply them, would be met by their competitors. He also went to La Plata and Ensenada, which was situated in their lighting area. They had no competition there, but there was no reason why they should not, as they possessed no monopoly and there was a powerful competitor for lighting in the presence of the local gas company. They had had a considerable growth in their business at those places, and new business was continuing to offer, and, from their point of view, probably one of the most important events in connection with La Plata and Ensenada was the conversion of the horse tramway system for electric traction. The conversion work had been assumed by a new company—the La Plata Electric Co., which was organised by a group of men with whom they had friendly relations, and they had taken a moderate share interest in the new company. They were, however, mainly concerned in the new venture from the fact that they had entered into a 10-years' contract with the company to supply them with the power they would require to run their tramways. The tramways were now in course of construction by Dick, Kerr & Co. The first section was opened in January, the second section in April, and it was anticipated that the remaining portions would be open by January, 1911. The arrangement was mutually advantageous, as they would be able to supply the tramway company cheaper than if they had erected their own power station, while, at the same time, it would pay them well. They had not derived any revenue from the tramways last year, but during the current year there would be an appreciable addition to their income, and as years went on the tramways would become more and more important customers. When he was at La Plata he studied on the spot the question of the most advantageous and the cheapest way of obtaining an extension of their station, which had become an absolute necessity. They had the choice of either extending at La Plata upon their existing site, or acquiring a fresh site and starting a supplemental station at Ensenada. They had decided upon the latter course, and had secured an excellent site in the port and on the banks of the river. That would be a great advantage, from the fact that the principal items in producing electricity were coal and water. They were erecting a most modern plant of big units, and had contracted for two 1,500-KW. turbo-alternators. The foundations were going in now; the contracts for all the plant had been made, and their expectation was that the station would be in actual operation in about 14 months from the present time.

MR. R. MILLER seconded the motion.

MR. LOWE asked whether the directors were going to issue fresh capital for making the extensions at Ensenada.

The CHAIRMAN, in reply, said that undoubtedly the extensions would mean a big capital expenditure, but they had large depreciation accounts on which they could draw, and at present the directors were looking to the business itself for a very substantial portion of the expenditure. A year ago they took power to raise £50,000 by way of preference shares, and they had only issued £25,000. They had no intention of issuing more at the present moment, but if it were requisite they had that call in reserve. It was not their intention to issue any additional ordinary shares.

The report was then adopted.

Rangoon Electric Tramway and Supply Co., Ltd.—

According to the directors' report it has been decided, owing to the increasing demand for energy, to extend the power station and to install an additional 2,500-KW. turbine set, increasing the capacity of the station to 5,900 KW., which will be ample to meet all demands within the near future. The traffic receipts for the year 1909 increased by over 15 per cent., and the traffic so far received for the current year show a further steady growth. The amount available for distribution is £5,930. The directors recommend a dividend on the ordinary shares of 3 per cent. for the year, free of income-tax, carrying forward £621.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended	Receipts for the fortnight. £	£*	No. of wks.	Total to date. £	£*	Route miles open.	Inc
Aberdeen	April 27	2,363	— 190	47	63,494	— 828	..	..
Ayr	,, 30	470	— 38	50	13,848	— 114	8	..
Bath	,, 30	1,464	+ 13	17	11,956	+ 1,197	..	..
Belfast	,, 29	7,551	+ 208	4	15,623	— 250	37	..
Birkenhead	May 1	2,028	— 16	4	4,461	— 286	18·63	..
Birmingham Corp.	April 23	13,316	— 179	3	21,766	— 1,497	56·46	..
†Blackburn	,, 20	947	— 46	3⅔	4,112	— 602	14·12	..
Blackpool Corp. ..	,, 27	969	— 187	..	2,095	— 2,048	..	..
Blackpool-Fleetw'd	,, 30	602	— 171	17	5,377	— 126	..	..
Bolton	,, 24	4,553	+ 47	4	7,648	— 1,458	26	..
Bournemouth ..	,, 27	3,250	+ 177	8⅔	6,067	— 1,228	21·98	..
†Bradford	,, 23	4,753	+ 124	4	15,602	— 1,924	54·81	..
Brighton	May 1	1,517	— 107	4⅓	3,607	— 694	9·5	..
Bristol	April 29	11,004	+ 720	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	,, 22	440	— 11	16	3,457	+ 89	3·65	..
Barnsley	,, 22	942	+ 23	,,	2,730	+ 116	..	..
Barrow	,, 22	448	— 19	,,	3,618	+ 343	6·37	..
Cavehill	,, 22	150	— 118	,,	1,168	+ 180	..	..
Devonport	,, 22	816	+ 53	,,	6,468	+ 650	8·35	..
Gateshead	,, 22	1,839	— 102	,,	15,194	— 260	11·25	..
Gravesend	,, 22	372	— 98	,,	3,013	+ 126	6·5	..
Greenock	,, 22	1,225	+ 52	,,	8,507	+ 1,170	7·25	..
Hartlepool	,, 22	420	+ 50	,,	3,302	+ 118	6·72	..
Kidderminster ..	,, 22	174	— 69	,,	1,386	+ 43	..	..
Leamington	,, 22	288	— 90	,,	2,319	— 12	..	..
Merthyr	,, 22	367	— 101	,,	3,048	— 197	2·9	..
Metropolitan	,, 22	13,857	+ 92	,,	108,436	+20,894	22	..
Middleton	,, 22	551	— 235	,,	4,446	— 403	8·5	..
Mid. Joint Com'tee	,, 22	10,847	—1,658	,,	85,458	+ 2,421	..	..
Oldham—Ashton	,, 22	1,027	— 234	,,	8,436	— 120	9·18	..
Peterborough ..	,, 22	204	— 63	,,	1,588	— 24	5·81	..
Potteries	,, 22	8,608	— 171	,,	27,319	— 310	29	..
Rothesay	,, 22	186	— 293	,,	1,159	+ 25	2·75	..
Southport	,, 23	505	— 192	,,	9,868	+ 135	8·17	..
S. Metropolitan ..	,, 22	1,513	— 354	,,	11,710	+ 728	..	..
Swansea	,, 22	1,985	+ 65	,,	15,559	+ 1,604	12·5	..
Tynemouth	,, 24	310	— 92	,,	2,479	+ 246	3·75	..
Weston-s-Mare ..	,, 22	110	— 168	,,	665	+ 2	3	..
‡Worcester	,, 22	497	— 111	,,	3,874	+ 84	5·75	..
Wrexham	,, 22	224	— 15	,,	1,484	+ 15	..	..
Yorks. Wool. Dist.	,, 22	1,903	— 86	,,	14,949	+ 1,500	17	..
Miscellaneous ..	,, 22	388	— 53	,,	3,087	+ 176	..	..
Burnley	,, 30	2,345	— 102	..	..	..	..	..
Burton-on-Trent ..	May 1	506	+ 20	4	1,110	— 70	6·62	..
Bury	,, 1	2,187	— 24	4⅓	4,912	— 754	22·5	..
†Cardiff	April 30	2,070	+ 6	5	8,917	— 824	..	..
†Carlisle	,, 12	155	+ 15	10	1,491	+ 46	..	..
Chatham and Dist.	,, 28	1,482	— 126	17	12,905	+ 541	14·98	..
Cork	,, 28	913	— 47	..	7,429	+ 302	9·89	..
Croydon	,, 15	3,105	— 155	..	8,295	— 437	..	..
Darlington	,, 30	357	+ 18	5	915	— 2	..	..
†Darwen	,, 22	227	— 10	3	693	— 177	4·36	..
Dover	,, 28	366	— 31	3	609	— 98	4·75	..
Dublin	,, 24	10,732	— 186	..	86,287	+ 2,951	54·25	..
Dundee	,, 27	2,259	— 55	49⅓	58,200	— 634	15·5	..
East Ham	,, 30	1,946	— 32	4⅔	4,193	— 154	8·52	·77
†Exeter	,, 29	289	..	4	1,210	— 195	5·5	..
Glasgow	,, 30	85,709	+ 988	..	812,393	+ 3,405	96·25	3·62
Hastings	May 2	1,740	— 263	..	..	..	..	..
Huddersfield ..	April 23	3,450	— 166	3	5,025	— 320	28·5	·5
Hull	,, 30	5,155	+ 257	4	11,221	— 179	14·5	1·5
Ilkeston	,, 28	234	— 6	4	448	— 93	..	..
Ipswich	,, 30	680	— 16	4	1,503	— 142	10·5	..
Kilmarnock	,, 30	280	— 9	50	7,220	— 205	4·25	..
Lancashire United	,, 27	2,400	— 9	..	20,704	— 82	39	..
Leeds	,, 30	13,366	+ 477	4	28,666	+ 40	..	..
Leicester	.. ..	..	..	..	..	..	..	..
Leith	,, 23	1,116	+ 86	49¼	28,846	+ 3,440	9	2
Liverpool	,, 23	21,513	— 219	16⅓	171,338	+ 3,958	113·5	6
‡L.C.C.	,, 16	79,280	+7,015	2⅔	91,219	+ 8,041	132½	9·12
London United ..	,, 30	11,653	— 37	..	96,899	+ 7,003	..	..
Lowestoft	Mar. 6	102	+ 26	23	3,368	+ 220	3·5	..
Manchester	April 30	28,423	+ 164	4	62,836	— 2,059	183	1
Newcastle	,, 30	7,484	— 4	..	16,051	— 762	14·5	..
Newport	,, 23	1,266	— 54	4	2,629	— 38	14·5	..
Oldham	May 1	3,542	— 154	5	9,958	— 951	23·75	..
Pontypridd	.. ..	..	..	..	..	..	..	..
†Portsmouth ..	April 30	1,783	+ 14	4	7,719	— 1,269	14·5	·75
†Preston	,, 20	708	— 1	3	2,025	— 244	..	..
Rotherham	,, 3	1,060	— 25	44	26,087	— 992	12	2
Salford	,, 25	8,939	+ 201	3⅘	15,612	— 1,096	..	..
Sheffield	,, 24	11,598	+ 341	4⅔	25,472	+ 609	39·8	2·8
†Southampton ..	,, 27	981	— 25	4	3,829	— 186	..	..
Southend-on-Sea ..	,, 27	883	+ 49	4	1,664	— 178	..	..
South Shields ..	,, 30	1,008	— 26	4⅔	2,174	— 177	..	..
Swindon	,, 27	255	+ 18	..	..	..	..	..
Tyneside	,, 27	746	— 25	17	6,459	— 320	..	..
Wallasey	,, 30	1,666	— 118	8⅔	3,603	— 568	..	..
Walthamstow ..	,, 30	1,252	+ 39	4	3,029	— 330	9	..
West Ham	,, 21	4,615	— 367	3	6,889	— 547	15·25	..
Wolverhampton ..	,, 27	1,690	+ 186	4	3,858	+ 80	14·25	1·75
Baker St.-Waterloo	,, 30	6,944	+ 220	17	58,370	+ 925	4·25	..
Cen. London Rly...	,, 30	11,148	+ 246	17	93,796	+ 372	6·32	·55
Char. +, Scs. Hamp.	,, 30	7,645	— 210	17	66,050	— 360	7·75	..
City & S. Lon. Rly.	May 1	6,497	+ 182	17	56,003	— 392	7·26	..
Dublin-Lucan Rly.	April 29	258	+ 2	17	1,962	+ 24	7	..
G.N. and City Rly.	,, 30	2,977	+ 101	17	25,717	— 469	3.5	..
G.N., P'y. & Brmm.	,, 30	12,300	+ 590	17	103,105	+ 4,340	9·25	..
L'pool Overh'd Rly.	May 1	2,727	+ 92	..	23,461	+ 160	6·8	4·8
Llandudno-Col. Bay	April 29	227	— 51	21⅔	3,036	+ 149	..	..
Mersey Railway ..	,, 30	4,158	+ 166	17	34,105	+ 700	4·5	..
Metropolitan Rly...	May 1	33,476	+ 869	..	278,755	+ 9,601	24·5	..
Met. District Rly...	April 30	22,013	+2,077	17	184,130	+18,316	24	..
Anglo-Argentine ..	,, 29	90,723	+7,842	..	741,279	+62,751	..	..
‡Auckland	,,	15,098	+1,162	16	59,086	+ 3,361	22·8	1·88
Bombay (B.E.T.) ..	May 1	5,469	+ 295	13	35,255	+ 2,279	..	..
‡Brisbane	March	17,990	+1,990	..	50,830	+ 5,704	..	..
‡Brit. Columbia Rly.	.. ..	..	..	..	..	..	..	..
Calcutta	April 30	6 846	+ 731	..	..	..	..	..
‡Cape Electric T. Ld.	.. ..	..	..	..	..	..	..	..
‡Kalgoorlie, W.A...	March	3,633	..	..	10,040	..	20·5	..
Madras	April 15	1,313	— 108	..	9,601	+ 424	..	..
‡Lisbon	.. ..	..	..	..	..	..	..	..
†Perth (W.A.) ..	,, 22	3 168	+ 184	..	25,486	+ 1,805	29	1

* Compared with the corresponding period of 1909. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

Rubber continues to hold a powerful ascendancy over other markets in the Stock Exchange, but its influence is now more malignant, for rumour sports with talk of failure, and sales have had to be made in order to meet rubber engagements. The tone throughout the markets is subdued, and for a few weeks it is not to be expected that activity will break out, except very spasmodically, in the leading sections of the House.

This present week has been broken by the Stock Exchange holiday on Monday and the Roman Catholic bourses' celebration of Ascension Day on Thursday. There is little disposition to enter into fresh commitments anywhere. The pace has dropped to something like dead-slow. When the rubber market settles down to normality again, there will undoubtedly be a better chance for other markets which have lately been so deserted in favour of the all-pervading gamble. In this connection a coming rise in Home Rails is again predicted, but of its advent it must be stated that there is not the least indication at present.

There is no movement in Central Londons, but City and South London receded ½, and Metropolitan Consolidated has gone back, Districts holding their price.

The traction market is not at all bad. British Electric Traction Preference have gone ahead again, the price rallying 10s., after its fall of 12s. 6d. in the previous week. Calcutta Tramways, *ex* 2s. 6d., have recovered the dividend. British Columbia Electric Deferred is unchanged at 147½, although the dividend of 4 per cent. has been deducted. Mexico Tramways are steady, but Rio Tramways are a weak market, the price declining to 95—97. The Gold Bonds are 98, and the Mortgage Bonds 86½. A good deal of business in Anglo-Argentine Tramways has not affected the prices of the securities.

British Thomson-Houston Debentures are still in demand, and once more the price has been put up a couple of points. Miscellaneous issues display few features. The quotation for Telegraph Construction shares has been reduced ½ in its lower figure, apparently with the object of covering a special bargain at 33½. A useful change is the quoting of Henley's Ordinary at a margin of 10s., instead of 15s., between the nominal selling and buying prices. India-Rubber, Gutta-Percha shares are 5s. easier.

The Electricity Supply division is steady, with a few rises here and there to mark a better tone about the market. Amongst the shares, Chelseas and Urban Preference are 5s. higher, while Metropolitan Preference lost half as much. Advances of a point or so are registered in City of London Second Debenture, County Second Debenture (allowing for deduction of the interest), Edmundson Debenture, and North Metropolitan Electric Power 5 per cent. Mortgages. South Metropolitan Ordinary fell ⅛. The Canadian-Mexican group displays no material movement.

In the Telegraph list, Anglo-American Deferred eased off in sympathy with a further drive at American Railroad prices. Eastern Extensions continue to mount quietly, and the price of the shares has reached 13½; the report out this week makes a capital showing. Eastern Telegraph Ordinary is 137. The full deduction from Indo-Europeans is £2 12s. 6d. per share, reflected by a fall of 3 in the quotation. Great Northern Telegraphs at 32 are ¼ higher.

National Telephone Preference shares and Debenture stocks are sagging as the time of redemption begins to draw nearer. Monte Video and Oriental Telephone shares are all *ex* dividend, without quotably affecting prices. The Rubber boom has been badly deflated. Tuesday's fiasco at the Mincing Lane sales upset the market in the Stock Exchange, where prices came down like a succession of children's card-houses.

Eastern Extension Telegraph Co., Ltd.—The report states that the gross receipts during the half-year to December 31st amounted to £315 034, against £306,889. The working expenses, including £17,997 for maintenance of cables, absorb £143,674, against £151,507, leaving a balance of £171,360. From this is deducted £3,841 for income-tax payable in England, and £15,048 for interest on debenture stock, leaving as the net profit for the half-year £152,471. After adding £58,844 brought forward, there is an available balance of £211,315. One quarterly interim dividend of 1¼ per cent. has been paid for the half-year, and it is now proposed to distribute another of like amount, making with the interim dividends paid for the first half-year a total dividend of 5 per cent. It is also proposed to pay a bonus of 4s. per share, or 2 per cent., making a total distribution of 7 per cent. for the year 1909. The sum of £50,000 has been transferred to the general reserve fund, and £26,315 is carried forward.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations April 26th.	Closing Quotations May 3rd.	Business done week ended May 3rd. 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	8⅜ — 8¾	8⅜ — 8¾	..	..	..	Nil.
116,200	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
$335,196,000	American Telephone & Telegraph, Cap. Stock ..	$100	8 %	8 %	8 %	8 %	138 —141	138 —141	..	..	..	5 13 6
$68,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 58,001 to 72,000	$1000	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 3
558,460	Anglo-American Telegraph	Stock	5⅞%	5⅞%	£3 4s.	3⅜%	59 — 61 xd	59 — 61	..	..	..	5 18 10
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	101 —102 xd	101 —102	101⅛	101	..	5 17 8
3,220,770	Do. do. do. Deferred	Stock	1⅞%	1 %	8/-	25/-	18 — 18½	17⅞ — 18½	18	17⅞	— ½	6 17 0
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	99½ —101⅛	99½ —101⅛	..	..	..	4 18 6
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8⅛ — 8⅜	8⅛ — 8⅜	..	..	..	4 16 3
2,449,176	Commercial Cable, Sling. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	86 — 88	86 — 88 xd	87	..	..	4 10 11
16,000	Cuba Telegraph	10	5 %	6 %	6 %	6 %	8⅞ — 9⅛	8½ — 9 xd	..	..	..	6 13 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17½ — 18½	16½ — 17½ xd	..	..	..	5 17 8
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	3⅛ — 3⅜ xd	3⅛ — 3⅜	..	..	..	5 3 3
5,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	7⅞ — 8⅛ xd	7⅞ — 8⅛	..	..	..	6 1 3
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
60,710‡	Direct United States Cable	20	4½%	4½%	4½%	4 %	13½ — 14	13½ — 13⅝	13⅝	..	— ⅛	5 18 6
89,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,966, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock.	Stock	7 %	7 %	7 %	..	185½ —188½	186 —189	188	..	+ ½	5 0 9
2,000,000	Do. 8½ % Pref. Stock..	100	8½%	8½%	8½%	8½%	86 — 88	86 — 88	..	..	..	4 1 5
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	103 —105	101 — 103 xd	101	..	..	3 17 8
300,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	12⅜ — 13½	13 — 13½	13⅜	13	+ ½	5 3 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	99½ —101½ xd	..	..	..	3 18 10
200,000‡	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	101 —103	99½ —101½ xd	..	..	..	3 18 10
181,127	Globe Telegraph and Trust	10	5⅛%	5⅛%	5⅛%	..	10½ — 11	10½ — 11	10⅛	10⅜	..	5 4 7
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13½ — 13⅝	13½ — 13⅝	13⅛	13⅜	..	4 8 1
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	20 %	20 %	18 %	..	31½ — 32½	30⅜ — 31⅛	..	..	— ½	5 16 8
5,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	54½ — 56½	51½ — 53½	56 7/16	..	—3½	7 0 2
$41,380,400	Mackay Companies Common	$100	3½%	4 %	4 %	4½%	92 — 94	88 — 93	..	..	—1½	4 11 5
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	78 — 82	78 — 80	..	..	—1	5 0 0
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	3/16 — 7/16	3/16 — 7/16	16/9	15/9	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	6 %	1/16 — 1/8	1/16 — 1/8 xd	..	..	..	6 0 0
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	3/16 — 7/16	3/16 — 7/16 xd	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	104 —105½	104 —105½	104½	104	..	5 13 9
5,725,000	Do. do. Def. Stock	100	6 %	6 %	6 %	6 %	124 —126	124 —126	125½	124	..	4 15 3
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10⅜ — 10⅞	10 — 10⅜	10½	..	— ⅛	5 11 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10 — 10½	10 — 10⅜	..	..	..	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 3/16 — 5 7/16	5 3/16 — 5 7/16	..	..	..	4 11 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	97½ — 99⅜	97 — 99 xd	97½	..	..	3 11 8
1,988,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	98 —100	98 —100	98	..	..	4 0 0
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	8 %	8 %	8 %	1⅜ — 1½	1 1/16 — 1 1/8 xd	31/3	29/-	..	4 14 10
50,000	Do. do. 6 % Cum. Pref...	1	6 %	6 %	6 %	6 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16 xd	..	..	..	4 14 9
196,955	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	..	..	..	4 10 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
11,889	Reuter's	8	5 %	6 %	5 %	..	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red. ..	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	..	128 —131 xd	128 —131 xd	..	..	..	4 11 7
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	7⅛ — 7⅜	7⅛ — 7⅜	7 1/16	6⅞	..	5 8 6
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	5⅛	..	..	4 8 11
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 63,008	2½	2½%	2½%	2½%	..	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	..	13½ — 14	13½ — 14	13⅞	13 13/16	..	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	3/16 — 7/16	3/16 — 7/16	15/-	..	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	8 %	6 %	6 %	..	8½ — 9½	8½ — 9½	9⅛	8⅞	..	6 9 9
4,569	Do. do. 6 % Cum. 2nd Pref.	10	Nil	£2 6	15 %	..	8½ — 9½	8½ — 9½	..	..	..	6 9 9
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100⅛ —102⅛	100⅛ —102⅛	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1s Pref., 1 to 640,000	5	..	..	..	5 %	4 1/16 — 4 1/8	4 1/16 — 4 1/8	96/8	93/9	..	5 1 8
500,000	Do. 5 % 2nd Pref., 800, to 1,300,000	5	..	..	..	5 %	4 7/16 — 4 1/2	4 7/16 — 4 1/2	90/-	..	..	5 6 8
4,466,674	Do. 4 % Deb. Stock	Stock	..	..	4 %	4 %	92½ — 93	90½ — 92	91¼	90⅝	..	4 7 0
382,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	£99	5 %	5 %	5 %	5 %	105 —107	105 —107	106	..	..	4 13 6
280,000	Babcock & Wilcox, 1 to 280,000	1	20 %	20 %	20 %	24 %	5⅛ — 5¼	4⅞ — 5⅛	5 1/16	5 1/16	— ⅛	4 14 1
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8 xd	28/9	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	Nil	..	..	..	..	..	..	Nil
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	3½%	..	..	..	..	..	..	..
40,100	Do. do. "A" 6 % Cum. Pref. ..	5	6 %	6 %	6 %	..	..	..	..	..	..	..
12,597	Do. do. 4 % Funding Certs. ..	5	4 %	4 %	2 %	..	..	..	..	..	..	..
134,400	Do. do. 5½ % Loch Leven Debs.	100	5½%	5½%	5½%	5½%	97 —100	97 —100	..	..	..	5 10 0
500,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	8 %	8 %	8 %	145 —150	145 —150 xd	..	..	..	5 6 8
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	121 —125	121 —125	124⅜	123⅜	..	4 16 0
400,000	Do. 5 % Cum. Perp. Pref. Stock ..	100	5 %	5 %	5 %	5 %	108 —110	108 —110	109	108½	..	4 10 11
235,000	Do. 4½ % 1st Mort. Debs., 1 to 5,250	40	4½%	4½%	4½%	4½%	101 —103 xd	101 —103	..	..	..	4 7 5
212,500	Do. 4½ % Vancouver Power Debs., 1 to 2,900	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
138,801	British Electric Traction	10	Nil	Nil	Nil	..	1 — 1⅛	1 — 1⅛	..	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	3 %	1½%	..	8⅛ — 8⅞	8⅞ — 9⅛	75/8	..	+ ⅛	4 0 0
1,473,553	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	90 — 92 xd	90 — 92	9 4/8	91	..	5 7 6
526,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	..	68 — 72	66 — 71 xd	..	..	..	6 6 9
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	10 %	6⅞ — 7⅛	6⅞ — 7⅛	6 15/16	..	..	6 17 11
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6 — 6⅛	6 — 6⅛	..	..	..	4 12 4
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
804,940‡	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	93 — 96	98 —101	..	..	+5	4 9 1
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	..	3/16 — 7/16	3/16 — 7/16	..	..	..	Nil
1,818,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	..	47 — 51	47 — 51	49½	48½	..	7 16 10
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	2/16 — 3/16	2/16 — 3/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	Nil	..	0 — 1/8	0 — 1/8	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	Nil	Nil	Nil	..	0 — 1/8	0 — 1/8	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	39 — 44	39 — 44	..	..	..	10 4 6
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	25 — 29	25 — 29	..	..	..	15 3 0
187,510	Calcutta Trams, 1 to 187,510	5	8 %	6 %	4½%	4½%	4⅜ — 4⅝	4⅜ — 4⅝ xd	96/8	95/-	..	4 12 4
45,804	Do. 5 % Cum. Pref., Nos. 1 to 59,830..	5	5 %	5 %	5 %	5 %	4½ — 5	4½ — 5	97/9	96/3	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	10 — 10⅜	10 — 10⅜	..	..	..	6 19 6
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 10 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102½ —104½	102½ —104½	..	..	..	4 6 2
491,223	Cape E. Trams., 1 to 491,223	1	Nil	Nil	Nil	Nil	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	12 %	12½%	..	2 2/16 — 2 3/16	2 2/16 — 2 3/16	56/6	55/-	..	4 7 9
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	4½%	104 —107	104 —107	..	..	..	4 4 1
1,890 690	Central London Railway, Ord. Stock	Stock	4 %	3 %	3½%	3 %	70 — 72	70 — 72	70⅛	70⅛	..	4 8 4
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	86 — 88	86 — 88	87½	..	..	4 10 11
554,655	Do. do. Def. do.	Stock	4 %	2 %	2½%	2 %	53 — 55	53 — 55	..	..	..	3 12 9
1,480,000	City and South London Railway	Stock	3½%	3½%	1½%	1⅜%	35 — 36	34⅛ — 35⅛	35	..	— ⅛	4 18 7
85,000	Crompton & Co., Nos. 1 to 85,000	5	5 %	5 %	Nil	..	3/16 — 7/16	3/16 — 7/16	..	..	..	Ni
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	88 — 91	88 — 91	..	..	..	5 9 7

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations April 26th.	Closing Quotations May 3rd.	Business done week ended May 3rd, 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
		*										£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	6 %	..	7/8 — 1	7/8 — 1	..	..	..	6 0 0
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000 ..	1	6 %	6 %	6 %	6 %	1 1/32 — 1 3/32	1 1/32 — 1 3/32	..	..	..	5 4 4
271,080	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½%	2½%	Nil	..	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
17,189	Do. "A" shares, 01—017,189 ..	5	4½%	2½%	Nil	..	1 — 1½	1 — 1½	..	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	65 — 70	65 — 70	..	..	..	5 14 4
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	79 — 82	79 — 82	..	..	..	6 1 11
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890..	2	7 %	7 %	7 %	7 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	9 0 8
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	..	7¾ — 8¼	7¾ — 8¼	..	..	..	6 1 8
200,000	Do. do 4 % Mort Deb... ..	Stock	4 %	4 %	4 %	4 %	82 — 86	82 — 86	..	..	..	4 18 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	1½%	Nil	..	1/2 — 1	1/2 — 1	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	..	..	10½ — 10¾	10½ — 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 — 103½	102 — 103½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15%	15 %	15 %	12⅜ — 13⅛	12⅜ — 12⅝	12⅜	..	— ⅛	5 17 8
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5⅜	5 — 5⅜	..	..	..	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105½—107½	105½—107½	..	..	..	4 3 9
60,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10 %	10 %	10 %	10 %	15½ — 16	15 — 15⅝	16⅛	15	— ¼	6 7 0
27,500	†Liverpool Overhead Railway, Ord.	10	Nil	½%	Nil	Nil	⅜ — ⅞	⅜ — ⅞	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	8 13 11
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	Nil	..	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
399,980	Do. do. 50,008 to 100,000	10	3 %	3 %	Nil	..	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
195,000	Do. do. 5 % Cum. Pref., 1 to 195,000	10	5 %	5 %	3⅜%	..	2⅛ — 3	2⅛ — 3	..	..	..	12 0 0
1,649,980	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	..	4 %	4 %	69 — 72	69 — 72	..	..	..	5 11 1
5,782,062	Metropolitan Consolidated	100	1 %	½%	..	1 %	43⅛ — 43⅜	43⅛ — 43⅜	44⅛	42½	..	2 5 9
2,640,914	Do. Surplus Lands	100	2¾%	2¾%	2¾%	2¾%	67 — 69	67 — 69	68	67	..	3 19 9
8,235,000	Do. District	100	Nil	Nil	Nil	Nil	22⅜ — 23⅛	23 — 23⅜	23½	..	+ ⅛	Nil
801,337	Metropolitan Electric Trams., Ord.	1	..	..	4½%	..	2⅜ — 2⅝xd	2⅜ — 2⅝	13/16	..	..	5 15 0
314,016	Do. do. Defd...	1	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	2/8	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	1⅛ — 1⅜	1⅛ — 1⅜	15/6	..	..	6 8 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	97 —100	97 —100	98½	97½	..	4 10 0
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	129 —131 xd	129 —131	..	..	..	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	5 %	..	94⅜ — 95⅜	94⅜ — 95⅜	95½	95	..	5 4 2
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	⅜ — ½	⅜ — ½	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅜ — ½	⅜ — ½	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	84 — 87	84 — 87	85	84½	..	5 3 6
37,350	Telegraph Construction and Maintenance	12	15 %	17½%	15 %	17½%	34 — 35½	33¾ — 35½	33⅛	..	— ½	5 16 0
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	5 %	..	102½—103½	100 —101 xd	103½	103¼	..	4 19 0
2,800,000	Do. do. 4½% Bonds	..	..	..	4½%	4½%	89 — 91	88 — 90	89½	89	—1	5 0 0
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	38 — 40	38 — 40	39½	..	..	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	1	Nil	10 %	5 %	Nil	⅛ — ¼	⅛ — ¼	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	5	..	6 %	6 %	3 %	1¾ — 2⅛	1¾ — 2⅛	36/3	35/-	..	1 4 2
245,495	Do. % 1st Mort. Deb. Stock			4 %	4 %	4 %	68 — 73	65 — 75	65	..	— ½	5 6 8

ELECTRICITY SUPPLY COMPANIES.

30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10%	10 %	10 %	10 %	7⅜ — 7⅞	7⅜ — 7⅞	7⅞	..	..	6 10 1
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 — 7⅛	7 — 7⅛	..	..	..	4 13 4
400,000	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..	3 17 8
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	4 — 4⅛	4 — 4⅛	..	..	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Pri.	5	4½%	4½%	4½%	4½%	8¼ — 4⅜	8¼ — 4⅜	81/3	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
49,436	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	4½%	3⅝ — 4⅛	3⅝ — 4⅛	81/3	..	..	5 9 1
175,000	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,596	10	6 %	6 %	6 %	7 %	11¼ — 12	11¼ — 12	11¼	..	..	5 16 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12 — 13	12 — 13	12 1/16	12 1/16	..	4 12 4
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	121 —125	121 —125	..	..	..	4 0 0
300,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	99 —102	100 —103	..	..	+1	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	Nil	Nil	1⅜ — 2	1⅜ — 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	2⅜ — 3⅛	2⅜ — 3⅛	..	..	..	7 13 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	94 — 96	94 — 96	..	..	..	5 4 2
40,000	County of London Electric Lighting, Ord. 1—4,000	10	5 %	5 %	5 %	5 %	7⅜ — 8	7⅜ — 8	7⅞	7 23/32	..	6 5 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜ — 11½	10⅜ — 11¼	10⅞	..	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	103 —106	103 —106	103	102	..	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	100 —103	99 —102 xd	..	..	..	4 8 8
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	Nil	Nil	Nil	..	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	Nil	Nil	..	1¼ — 1½	1¼ — 1½	..	..	..	Nil
420,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	..	72 — 75	73 — 76	..	..	+1	5 18 5
$8,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	5 %	5 %	82 — 85	82 — 85	..	..	..	5 17 8
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	5 15 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	4 15 8
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	93 — 96	101 —104	..	..	+8½	4 6 7
15,000	Hove, 1 to 15,000	5	9 %	8½%	8½%	8½%	7 — 7⅞	7 — 7⅞	..	..	..	5 13 4
$1,976,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	102½—104½	102½—104½	..	..	..	4 15 8
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	8 %	8 %	7 — 7⅞	7 — 7⅞	..	..	..	5 6 8
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94½ — 96½	94½ — 96½	..	..	..	4 2 11
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	2½%	3 %	..	1⅜ — 2	1⅜ — 2	..	..	..	4 8 11
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	..	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 14 8
382,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½%	4½%	4 %	4 %	92 — 94	92 — 94	..	..	..	4 5 1
200,000	Metropolitan Electric Supply, 1 to 100,000	5	6 %	6%	5 %	5 %	4 — 4⅛	4 — 4⅛	..	..	..	5 11 1
76,191	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 5	4⅛ — 4⅞	95/-	..	— ⅛	4 12 4
235,000	Do. 4½ % 1st Mort. Deben. Stock ..	Stock	4½%	4½%	4½%	4½%	104 —107	104 —107	..	..	..	4 4 1
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83 — 86	83 — 86	..	..	..	4 1 5
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	..	84½ — 85½	84½ — 85½	85⅜	80	..	5 16 8
18,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	3½%	..	79 — 81 xd	79 — 81	80½	..	..	4 6 5
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	7 %	103 —105	100 —102 xd	104⅛	100½	..	6 17 8
12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	5 %	5 %	89⅜ — 90⅜	89⅜ — 90⅜	89½	..	..	5 10 2
950,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96⅜ — 98⅜	96⅜ — 98⅜	..	..	..	4 11 5
180,491	Newcastle-on-Tyne, 1 to 187,500	5	8 %	8 %	2½%	..	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	2 15 0
187,500	Do. 5 % Pref., 1 to 187,500	5	5 %	5 %	5 %	5 %	4⅛ — 4⅜	4⅜ — 4⅝	..	..	..	5 2 7
126,500	{North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265}	100	..	..	..	5 %	97 — 99 xd	99 —101	100	..	+2	4 19 0
16,863	Notting Hill Electric Lighting	10	7½%	7½%	7 %	..	11⅜ — 12⅜	11⅜ — 12⅜	..	..	..	6 9 10
20,000	Oxford, 1 to 96 and 407 to 20,319	5	7 %	7 %	7 %	7 %	6⅜ — 7	6⅜ — 7	..	..	..	5 0 0
119,894	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	2½%	6 %	8 %	9 %	1⅛ — 2	1⅛ — 2 xd	40/-	39/9	..	4 0 0
100,000	Do. do. 8% Non Cum. Pref. Nos.1 to 100,000	1	6 %	6 %	6 %	6 %	1⅜ — 1⅝	1⅜ — 1⅝xd	22/6	21/3	..	5 4 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —105	103 —106	..	..	..	4 15 3
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	10 %	10 %	10 %	10 %	8¾ — 9	8¾ — 9	8⅞	..	..	5 14 8
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6⅞ — 7⅛	6⅞ — 7⅛	6⅞	..	..	5 7 8
150,000	Do. do. 3½ % Deb. Stock Red. ..	100	3½%	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	Nil
85,000	South London Electric Supply, Ord.	4	8 %	6 %	5 %	5 %	2¾ — 3⅛	2¾ — 3⅛	..	..	..	6 9 0
180,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	100 —103	100 —103	..	..	..	..
120,000	South Mes. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	⅝ — ¾	½ — ⅝	..	..	— 1/16	5 0 0
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 — 1⅛	1 — 1⅛	..	..	..	6 4 5
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	⅞ — 1	⅞ — 1	..	..	..	10 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	1⅜ — 2	1⅜ — 2⅜	..	..	+ ⅛	10 10 6
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	79 — 81	79 — 81	..	..	..	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000 ..	1	..	..	..	5 %	5/8 — ¾	⅝ — ¾	..	..	..	5 6 8
100,00	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	10 %	8¾ — 9	8¾ — 9	8¾	8½	..	5 11 1
51,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	5⅛	..	..	4 1 10

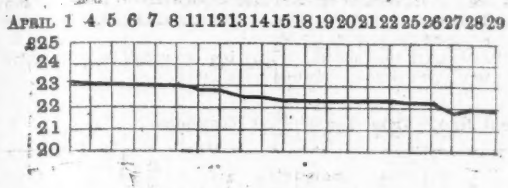
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 4 per cent., March 17th, 1910.

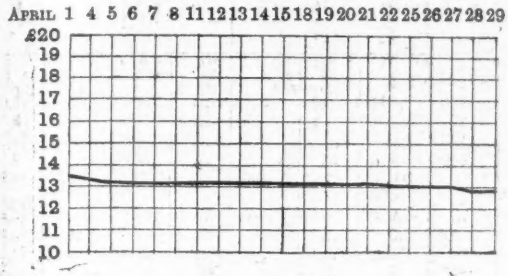
METAL MARKET.

Fluctuations in April.

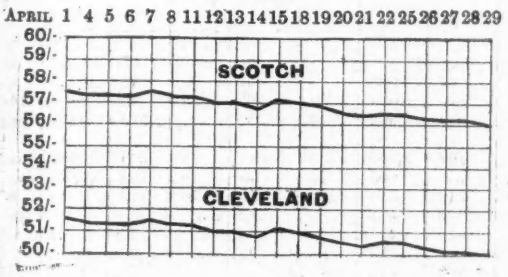
SPELTER (G.O.B's.).



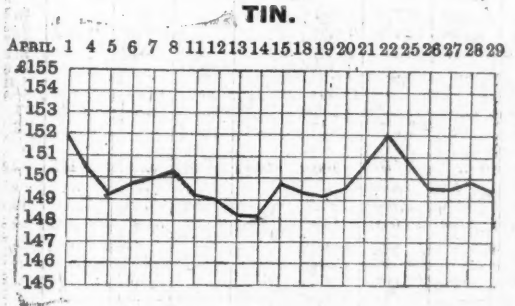
LEAD (ENGLISH).



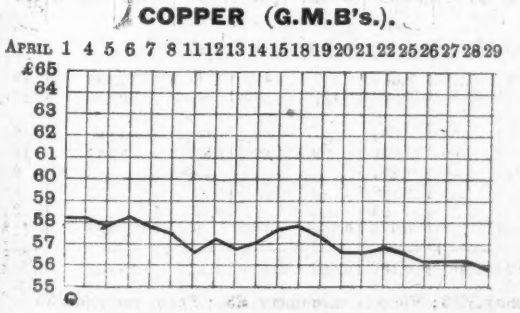
IRON.



TIN.



COPPER (G.M.B's.).



Manchester Exhibitions.—It is stated by the promoters of the Manchester Engineering and Machinery Exhibition (the proprietors of the *Engineering Review*) that want of space prevents them from making a complete section of colliery and mining machinery on this occasion. They have, therefore, resolved to organise a General Mining and Colliery Exhibition to be held next year (October 16th to 30th, 1911) in the City Exhibition Hall, Manchester.

THE USE OF ELECTRICITY IN GERMAN MINES.

In a review of the present position of electric power transmission in the German mining districts, the *E.T.Z.* finds evidence of steady progress. The view that electric transmission is a necessary evil is fast disappearing under the constantly repeated proof of its economy and reliability. Electricity is, in fact, now often used not only for the work of the mine, but also as a means of using up quantities of unsaleable coal at the pit mouth, and so effecting a profitable sale, if not of the coal itself, yet of the energy contained in it.

The excellent mine installation rules published by the Verband Deutscher Elektrotechniker last year are leading to a welcome standardisation of these installations. In spite of the fact that thoroughly protected apparatus of every type is now available, there is still some prejudice against the use of electricity in fiery mines, but it seems probable that this also will gradually disappear, and that electricity will more and more replace the uneconomical compressed-air systems.

In connection with pumping machinery, of both the fixed and portable types, electricity is very largely used, because of its economy and simplicity in operation. The motors for the portable pumps are usually totally enclosed squirrel-cage polyphase ones, and the pumps are high-pressure centrifugal ones, with vertical spindles directly coupled to the motors. Special armoured flexible cables, without lead covering, are used for this purpose, and can work safely at voltages up to 3,000. For stationary pump installations centrifugal pumps are largely replacing piston pumps because of their smaller cost and the small space they occupy, but piston pumps are still used in some cases because they are less sensitive when dealing with dirty water. The motors are usually polyphase direct-coupled ones, and, for the smaller sizes, have squirrel-cage rotors, but for the larger sizes, slip-ring rotors with short-circuiting and brush-lifting devices are preferred. Sizes up to 1,600 H.P., running at 1,500 R.P.M., are in use in some of the wet mines.

Large motors of 1,500 H.P. or more are also in use for main shaft ventilator driving, and are often combined with regenerative devices, such as converters connected to the slip-rings of the main induction motor, for the purpose of returning energy to the line when the speed of the main motor is lowered. Sometimes the same economy is attained by connecting the converter to an auxiliary motor mounted on the main motor spindle. In this way the speed of the main motor can be reduced to about 70 per cent. of full speed without lowering the combined efficiency below about 88 per cent., although the power required by the fan at the lower speed may fall to one-third of its full value.

The large main shaft haulage schemes offer attractive scope to the energies of the electrical engineer because of the many difficulties to be dealt with in working, and improvements are constantly being devised. The Ilgner system, however, still holds its own. The simple driving of the haulage machine by a plain induction motor, without regenerative arrangements to meet the great load fluctuations, is no longer in favour in Germany for heavy work. In cases where a considerable additional load is required for other purposes than haulage, a steam turbine driving the generator for haulage work and a second generator for the other load is sometimes employed in place of the Ilgner-Ward-Leonard arrangement, on the score of simplicity.

The many practical advantages of electric haulage over steam haulage are gradually bringing the former to the front. Not only in coal mines, but also in alkali mines, &c., measurements extending over a month or more have shown average over-all efficiencies from the steam engine to the rope as high as 45 per cent. Even with the small steam consumption obtainable with modern steam-haulage plants during actual work, the economy of the electric haulage over a long period is far superior, owing to the reduced losses during the intervals between actual haulage periods.

The economy of the electrical system is also one which increases steadily with the extension of the mine. The larger the generating station and the units employed the lower is the cost of a KW.-hour, and this has led to the centralisation of the power stations in many German mining districts. In the small mining district of Upper Silesia, for instance, generators totalling 92,000 KW. are installed for the mines, and there is also a public supply company with 34,000 KW. installed. The tendency to interconnect the various mines amongst themselves has gradually raised the voltage employed. One transmission is now carried out at 50,000 volts, and there are many others at from 10,000 to 20,000 volts.

The load factors are usually good. Thus, a single station with generators for 3,000 KW. installed, generates over 8 million units a year, whilst the above 34,000-KW. station has generated 85 million units in the year. The generating cost is, consequently, low, varying from 36d. to 6d. per unit, including interest and sinking fund.

In the Rheinland-Westphalia mining district, generators totalling 170,000 KW. are installed, and over 3,000 motors totalling 170,000 H.P., and the generating cost here is from 3d. to 36d. The largest single station has 55,000 KW. installed, and over 140 million units were sold for mining, smelting and traction work.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING MARCH, 1910.

The returns of the electrical export business for March reached the unusually big total of £874,000, a figure which easily beats anything which we have previously recorded, and which, we believe, constitutes a record. As on one or two previous occasions of record figures, this is due to the inclusion of a large telegraphic export, amounting in this instance to over half a million pounds. But even allowing for the whole of the telegraphic exports, there remains a substantial total of £252 234 for general business, which is comparable with £218,163 in February.

The import section also reached a good figure, £181,530, which compares with £153,583 in the previous month; the re-export total of £21,304 shows some falling-off, but still remains considerably above the 1909 average.

Of the individual items, the telegraphic export total of £622,093, of course, dwarfs all others; but machinery with a total of nearly £120,000, telephonic material £30,469, and cables amounting to over £45,000, are also prominent items in the export section.

In the import section are included some £60,000 worth of lamps and £52,000 worth of machinery, Germany, as usual, taking the lion's share of the import business.

A substantial number of purchasing countries will be noticed, being much the same as in previous months.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	365	1,421	...	64	136	2,838	10	...	...	189	...	5,023
Germany...	184	1 841	54	160	232	1,221	2	15	...	23	138	3,870
Netherlands and Java	263	1,651	12	23	129	1,583	...	27	...	43	35	3,746
Belgium	221	1,607	389	196	850	1,136	...	...	...	389	...	4 788
France	982	16	418	90	...	3,072	...	140	...	18	170	4,906
Portugal	20	79	...	46	...	408	...	...	...	8	92	653
Spain, Spanish N. Africa and Canary Isles ...	124	81	173	...	...	2,923	18	45	...	12	54	3,430
Italy, Switzerland and Austria-Hungary ...	426	...	...	41	188	2,332	...	30	...	13	...	3,030
Greece, Roumania and Turkey	338	92	42	93	...	99	...	8	...	294	52	1,018
Channel Isles, Gibraltar and Malta	32	82	70	296	171	172	...	4	...	2	535	1,364
U.S.A., Philippines and Cuba...	18	...	...	91	4	470	2	...	643	...	4,509	5 737
Canada and Newfoundland	1,075	994	342	1,291	1,912	4,450	...	193	...	...	7,491	17,748
British West Indies and British Guiana ...	40	...	21	10	67	40	...	4	...	59	39	280
Mexico, Guatemala and Venezuela	48	702	...	291	...	116	...	2	...	...	38	1,197
Peru and Uruguay	17	46	...	56	...	...	...	36	...	39	31,251	31,445
Chile	178	354	80	383	49	955	...	156	14	38	60	2,267
Brazil	64	485	397	410	679	6,652	50	286	78	46	2 939	12,086
Argentina	2,505	3,718	1,124	2,197	974	12,301	900	753	...	3,525	6,172	34,169
Egypt	228	511	40	...	102	1,045	3	192	21	106	20,245	22,493
British West Africa and Ascension	202	223	88	41	...	65	13	35	24	128	541,004	541,823
Cape of Good Hope	1,155	2,243	63	618	310	3,055	290	226	19	124	97	8,200
Natal	800	7,859	954	148	176	3,539	...	112	...	184	...	13,772
Rhodesia, O.R.C. and Transvaal	1,379	2,505	127	870	326	1,620	...	196	...	163	389	7,575
Zanzibar, Brit. E. Africa, Mauritius and Aden	21	131	4	194	29	10	...	202	...	23	136	750
Azores, Madeira and Portuguese Africa ...	516	854	...	53	103	415	12	...	...	24	1,360	3,337
China and Siam	486	3,940	281	717	280	3,727	188	40	...	8 261	185	18,105
Japan	536	2,9-6	12	159	1,088	11,776	4,765	...	...	3,279	3,014	27,585
India	1,637	2,886	883	1,622	347	13,041	4,250	2,821	58	86	979	28,610
Afghanistan	35	218	...	...	...	...	...	...	...	...	...	253
Ceylon	5	431	72	56	3	12	160	179	...	171	120	1,209
Straits Settlements and Fed. Malay States...	77	158	34	43	...	206	216	108	...	...	320	1,162
Hong Kong	162	135	493	93	265	2,324	...	81	...	...	...	3,553
West Australia	353	229	15	111	...	1,051	200	244	16	...	175	2,394
South Australia...	784	103	57	248	12	2 815	...	8	...	...	...	4,027
Victoria	1 511	2 978	122	868	554	5,150	280	25	22	4,741	...	16,251
New South Wales	1,867	2,014	152	1,024	390	11,612	601	248	97	6,043	329	24,377
Queensland	40	122	40	...	35	342	1,689	15	...	8	...	2,291
Tasmania	25	...	...	...	...	1 791	...	8	23	165	...	2,012
New Zealand	607	1,790	455	526	160	1,639	42	142	...	2,265	165	7,791
Total, £	19,326	45,485	7,014	13,099	9,571	105,983	13,691	6,581	1,015	30,469	622,093	874,327

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Norway, Sweden and Denmark	176	...	...	97	...	1,860	7	429	60	10,516	13,145
Germany...	392	11,549	2,398	55,457	2,152	32,573	137	1,122	5,551	10,538	121,669
Holland	...	35	...	2,037	...	2	...	...	8	2	2,084
Belgium	557	799	74	149	104	994	...	228	665	3,980	7,530
France	...	130	1,011	1,352	169	4,021	38	1,676	3,398	1,577	13,392
Switzerland	6	69	8	484	42	1,374	...	10	189	...	2,182
Italy	...	1,843	...	...	...	126	...	...	...	240	2,209
Austria-Hungary	...	525	12	919	...	63	...	17	2,453	...	3,989
United States	2,091	199	701	117	...	5,376	6,304	122	88	165	15,163
Total, £	3,222	15,149	4,204	60,592	2,487	46,189	6,486	3,604	12,412	27,018	181,363

Additional imports: Canada, lamps, £84; New South Wales, machinery, £23; Victoria, machinery, £30; Spain, carbons, £30.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	£	£	£	£	£	£	£	£	£	£	
Various countries, mainly as above	2,760	1,236	...	2,060	...	2,410	...	289	897	11,652	...

Total Exports: £874,327. **Total Re-Exports: £21,304.** **Total Imports: £181,530.**

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

PROCEEDINGS OF INSTITUTIONS.

Earthed v. Insulated Neutrals in Colliery Installations.

By W. W. Wood, A.M.I.E.E.

(*Paper read before the* Institution of Electrical Engineers, *Newcastle, April 25th, and London, April 28th*, 1910.)

A great deal of attention has recently been attracted to the question whether a three-phase colliery installation should work with an earthed or insulated neutral, and not only are there a number of supporters of both systems, but also a number of long-standing examples of each at work on both high and medium pressures, and with current taken in some cases from a supply company and in others from their own generating plant. Conditions vary so greatly in collieries and mines that what is suitable and perhaps necessary in one case may be absolutely dangerous in another. The principal advantages of each system are as follows:—

Earthed Neutral.	*Insulated Neutral.*
1. Maximum potential to earth of any phase limited to 58 per cent. of line voltage.	1. Danger of shock and explosion is reduced, as contact with earth and one phase does not complete the circuit.
2. Leakage to earth probably results in isolation of the damaged circuit.	2. An earth on one phase does not cause an interruption of supply, for the same reason.
3. Leakage tripping devices can be used which switch off the supply when an earth occurs on one phase, reducing danger of shock and explosion.	3. Stress on insulation under normal circumstances is less, and liability to flash to metallic casings considerably less.
	4. Only two trip coils instead of three are required to protect each circuit where an automatic switch is installed.

As the principal consideration is the safe operation of the underground plant, it is only proposed to consider briefly how the question affects generating machinery and transmission lines. Many collieries now take their power from a supply company, and where such an installation is connected without the intervention of a transformer, advantages 1 and 2 of the insulated system are minimised, as an earth on any part of the supply company's mains (possibly in another colliery) will have the same effect as an earth on the installation, but be beyond its control. Under such circumstances, and particularly where the voltage is high, say 5,000 or over, it is probably better to earth the neutral so that a faulty installation is isolated, and the stress to earth on healthy plants kept permanently at 58 per cent. of the line volts. In a high-tension installation the factor of safety of insulation is often small, and the sudden rise of pressure produced by an earth on one part of the system may damage the insulation of another part or cause a flash-over on motors. Where the supply is transformed the colliery circuit is a separately insulated one, and the above does not apply.

As far as the generating plant is concerned (where a colliery has its own supply) the earthing or insulating of the neutral makes very little difference, as although with alternators in parallel triple-frequency currents may give trouble with an earthed neutral, this can be got over by only earthing the neutral of one generator, or by the introduction of choking coils, and this point was discussed in Mr Rider's paper on the London County Council Tramways. The conditions, moreover, under which most colliery stations work are less strenuous than those of a supply company, where interruption of the service affects a large number of concerns, so that the earthing of one generator at a time would probably work satisfactorily.

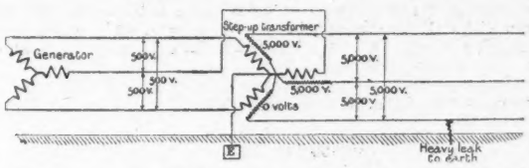
As far as transmission lines are concerned, the question of earthed *versus* insulated neutral is a very open one indeed, especially on voltages under 20,000, and the President of the High-Tension Committee of the American Institute of Electrical Engineers, in opening the discussion on this subject, put his conclusions as follows: "That some plants grounded the neutral, and their engineers considered it safe, and would never think of running in any other way, whilst the engineers of plants which did not ground the neutral would never think of doing such a thing."

Where the neutral is earthed, it has sometimes been found possible in emergencies to keep up the supply with two lines and an earth return, while with an insulated system the supply can be maintained with an earth on one phase, if the insulation of the system has a sufficient factor of safety to withstand the full line voltage between any part of it and earth. These points are of more importance on a supply company's system than on the average colliery installation.

Before considering the underground plant it is interesting to note that under certain conditions it is possible to get the full line voltage to earth in two phases of a system even with the neutral earthed on both high and low-tension sides of the transformers, if these are connected star to star, and the generator neutral is insulated. This is due to the instability of the neutral point under such conditions, and is illustrated in fig. 1. Very often the first indication of anything wrong is the arcing of the lightning arresters.

The chief considerations in the underground plant are safety as regards shock and explosion, reliability and simplicity in working, and cost both of the installation and maintenance of the same.

Although even on a perfectly insulated system of large size, or working at high pressure, it is possible to get a severe shock from the capacity effect alone, and without any actual circuit being completed, there is no doubt that on such a system there is less danger



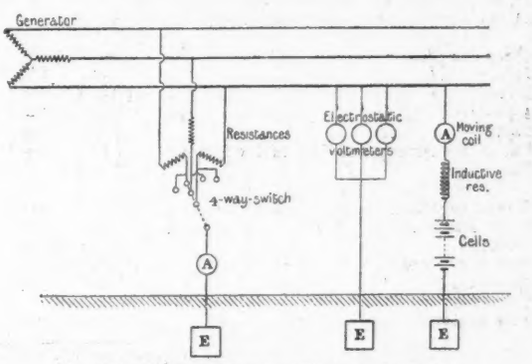
1. Transformers connected star to star, neutral earthed, generator neutral unearthed.
2. Earth occurs on one phase and short-circuits it.
3. Voltage on shorted phase falls to zero, on other two rises to full line volts, increasing stress on insulation of two phases in ratio of 58 to 100.

Fig. 1.

of fatal results from accidental contact with one live phase and earth, and particularly so on medium-pressure installations. It must be noted, however, that very often on these medium-pressure systems the neutral-point is connected to earth through the resistance of the leakage indicator, the connections being as shown on fig. 2. This resistance is generally designed to pass several hundred milliamperes, which is sufficient to give a fatal shock, and while it is, of course, much safer to get a shock in series with such a resistance which limits the current, this danger can be reduced by using the electrostatic type of indicator usually supplied for higher voltages, or the Nalder type of instrument which only passes a few milliamperes. Considered from this point of view there is no doubt that a system with earthed neutral presents greater dangers.

With an earthed system the voltage between any point and earth cannot exceed 58 per cent. of the line pressure, but as fatal accidents have occurred with voltages as low as 150, this limiting of the voltage is not of any very great advantage, particularly in a colliery, where the conditions are such as to make the men specially susceptible to the effects of electric shock.

The best protection against the danger of shock from conducting bodies does not lie either in earthing or insulating the neutral, but in properly protecting or enclosing all live parts, and in efficiently earthing to the surrounding ground all motor frames, switch-cases, &c. The earth wire should be large enough safely to carry the load which will blow the fuses of the plant it protects, and it should be frequently tested for continuity. In a dry pit it is

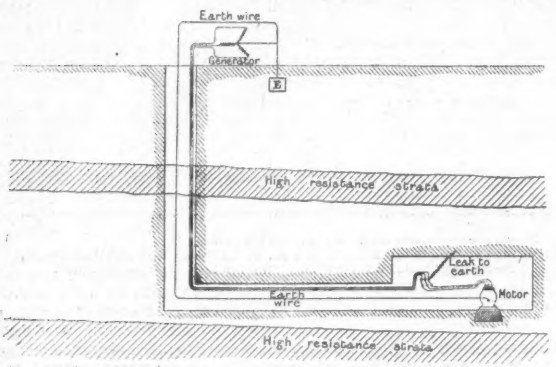


(The electrostatic voltmeters should be connected to the three phases, not as shown here.)

Fig. 2.—Various Types of Leakage Indicators.

often difficult to get a good earth connection, and to meet this difficulty some engineers carry either a separate cable or core for earthing purposes only, but this method may possibly be a source of danger unless the system is also earthed underground, and fig. 3 has been prepared to illustrate this. For example, on a three-phase system with an earthed neutral, and an earthplate at the generating supply end, a leak takes place near the motor on one of the outers. This motor is at work in a more or less insulating stratum, so that the resistance from the ground to the earthplate at bank (except through the earth wire) is very high. The motor makes bad contact with the ground on which it stands, and there is a very considerable difference of potential between this ground and the motor. Anyone standing on this ground and touching the motor case will get a possibly fatal shock. If the neutral is insulated it is necessary to have a leak on one of the other phases at bank before the same conditions can apply. It may be thought that this is a rather exaggerated case, but a non-fatal shock on somewhat the same principle as outlined above, and due to variations in the resistance of the strata, occurred recently in a colliery in Scotland, and on measuring the resistance between an earthplate at bank and an earth connection at the bottom of the shaft, this was found to be 100,000 ohms. With regard to this question of earthing, Messrs. J. G. and R. G. Cunliffe, in a very interesting paper read before the Manchester Local Section, have shown

that the resistance of an earthplate is often very considerable. Quite apart from any question of the intervention of non-conducting strata (as mentioned above), the resistance between two plates each 1½ ft. square, and arranged 200 ft. apart, may be about 30 ohms, so that a leakage current of a few amperes would cause a big drop in potential. Another very important point is that nearly 50 per



1. Motor at work in high-resistance strata, or in motor-room with such strata intervening, both above and below, between earth-plate at bank. No earth-plate underground.
2. Leakage or earth on one phase at same level as motor. Latter on concrete foundations insulated from surrounding ground, and maintained by earth-wire at same potential as earth-plate at bank.
3. Considerable difference of potential between motor and surrounding ground, with possibility of shock due to phase volts.

FIG. 3.

cent. of this drop occurs within 3 ft. of the plates. It appears all the more necessary, therefore, in earthing the metallic dead portions of any system to provide several earthplates distributed over the installation. There is no great advantage in making each plate more than about 4 sq. ft. in area.

There is, however, a possible danger of shock which cannot be guarded against in this way, and that is by coming in contact with faulty insulation, such as an unarmoured damaged cable. With an earthed system shock as before is certain, with an insulated system it is likely to be less severe. Where cables are armoured or enclosed in a metallic covering this danger cannot occur as long as the armouring or cover is efficiently earthed and electrically continuous. If, however, a careless jointer leaves the armouring disconnected after a hurried repair, or the armouring is eaten away by bad water, &c., the conditions are now more dangerous than before, as an earth may cause a considerable length of armouring to be alive, any part of which will give a shock. For this reason many colliery engineers object strongly to the use of armoured cables as being likely to produce a false feeling of security.

It is very doubtful whether many colliery managers would install electric plant at all in places where there is real and constant danger of inflammable gas or coal dust, as it seems fairly certain from recent experiments that an arc or flash with any moderate amount of power behind it will ignite either gas or coal dust in suspension if present in suitable proportions. With an earthed neutral, failure of the insulation of one phase to earth is practically bound to produce such a flash, while with an insulated system an earth on one phase shows on the leakage indicator, and there is, at any rate, a greater chance of isolating the section before any arc occurs.

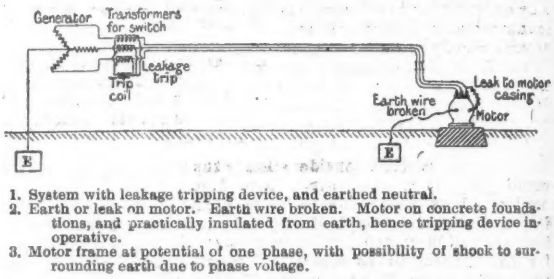
It is sometimes desirable to run certain plant even though it may be in a damaged condition. The stoppage of, say, a main haulage gear will disastrously affect the day's output of coal—a matter of very great importance to the colliery manager—and very possibly if the plant can be kept going for a few hours till the end of the shift, the fault can then be remedied without disorganising the working of the pit. In many such cases it may be perfectly safe and advisable to run, and as the majority of failures of colliery plant are leakages to earth, an installation with earthed neutral is likely to give more trouble than an insulated system.

If leakage trips are indiscriminately used, it is probable that unnecessary interruptions from trivial causes may be sufficiently troublesome to prejudice the manager against electricity and lead him to adopt some other motive power.

Several very interesting devices have been recently put on the market arranged to cut off current as soon as any leakage current exceeding, say, ½ ampere flows. They are only designed for use on a system with a neutral earthed either directly or through a resistance, and the current at which they operate can be adjusted to different values on different feeders as may be required. It is claimed that by using such switches in connection with armoured cables danger from shock and explosion is largely avoided, and Mr. Wedmore, in a paper read at Barnsley, gave the results of some very useful experiments on cables which tended to show that with such a device and armoured cables it was very unlikely that a fall of the roof could so damage the cable as to cause flashing or arcing externally. Even without the leakage trips and with only the ordinary overload devices it appeared to be generally necessary to subject the cable to "successive blows of a heavy hammer" before flame occasionally issued, and apparently also high-tension supply was safer in this respect than medium pressure. In case a cable were actually suddenly severed, it seems hardly possible that a flash of sufficient energy to ignite an explosive mixture could be avoided, whether a leakage trip was installed or not, and particularly if the point of failure was comparatively near generating plant of large capacity. It must be borne in mind, however, that many cables are run in places where there is no danger of explosion or of mechanical injury. It must also be noted that these devices depend absolutely on the continuity of the armouring or earthing being maintained, and if through carelessness or other cause this is not done they afford little protection against explosion and practically none against shock. A motor standing on concrete foundations is on a very good insulator, and if the earth connection were broken or inoperative insufficient current would flow to operate the leakage trip in case of leakage to the motor frame, which would then be raised above earth potential (fig. 4). We have previously seen that as long as earth connections are kept in good order there is no danger of shock from motor or switch casings or armouring, so that while there are undoubtedly many cases in which a leakage device may be of considerable use there are also many others where it would not justify the increased expenditure, and would probably prove rather a nuisance. These devices, moreover, do not protect against shock from live terminals or from contact with a high-resistance leakage.

In the author's opinion the simpler the installation can be made the more likely it is to be kept in good working order, and it has generally been found in the past that it is better to rely upon having good men to look after the plant and see that small details such as earthing, &c., are properly attended to than on automatic appliances.

As long as a system with insulated neutral is in good order the stress on the insulation is 16 per cent. less than on an earthed system, so that under equal conditions its factor of safety is greater. There is no doubt also that much greater clearances and creeping distances to all metal work must be provided where the neutral is earthed, to give the same factor of safety as on insulated



1. System with leakage tripping device, and earthed neutral.
2. Earth or leak on motor. Earth wire broken. Motor on concrete foundations, and practically insulated from earth, hence tripping device inoperative.
3. Motor frame at potential of one phase, with possibility of shock to surrounding earth due to phase voltage.

FIG. 4.

systems. The advantage of the earthed system is that an earth on one phase soon isolates the faulty part, and does not increase the stress on the other parts of the system, while a similar occurrence on an insulated system doubles the stress on the other places and is likely to cause further breakdowns. This point is of greater importance on extra-high voltages.

While not necessarily the first consideration, the question of cost in all engineering problems is of very great importance and one that will not be neglected by the colliery manager, whose business it is to get the best possible financial results.

Where automatic oil switches are used, three relays, one in each phase, are needed with an earthed neutral, and only two with an insulated neutral. If many switches are needed, the difference in first cost may be considerable.

The cost of armoured cable is often nearly double that of unarmoured, so that if these are run in places where there is no danger of accidental contact, damage from falls of roof or sets off the line, or of explosion, armouring is an unjustifiable expense.

The cost of maintenance is generally of greater importance than first cost, and it is here that the simplicity of the installation is of primary importance.

Conclusions.—No hard and fast rules can be laid down, and every case should be considered broadly on its own merits, but it certainly seems that generally an insulated neutral is better where permanent plant is at work and the cables are not very liable to mechanical damage. Where portable machines such as coal-cutters are used, or where cables are liable to frequent hard usage, it may be worth while to use automatic devices; and in this case, if a separate transformer were used to supply this plant, its neutral could be earthed (preferably through a resistance) without interfering with the remainder of the system. Such devices, however, will require constant inspection. There is another very important case which has not so far been considered, and that is where small lighting transformers are used. It would seem desirable to limit the secondary pressure of these to 110 volts and connect either the neutral or one side directly to earth. Finally, the author wishes to disclaim any sympathy with the present scare in regard to the use of electricity in mines. It is necessary in a paper of this sort to consider how accidents can and may occur, but the number that actually do occur is extraordinarily small considering the present widespread use of electricity and the insufficient electrical staff employed in many collieries. The average number of deaths caused by the use of electricity in mines appears to be about 1 per cent. of all the accidental deaths in such places, and many of these cases have been due simply to pure accident or carelessness which nothing could have prevented.

Discussion at London.

The discussion was opened by Mr. Wilson, who said that the keynote of the author was that each case should be taken on its merits, but his tendency was towards avoiding earthing the neutral. He (the speaker) believed in earthing. All underground cables should be armoured, and the armouring and neutral point of the system connected to earth. He could not agree that the danger of shock was minimised with an insulated system, as it was impossible to avoid earths at some time or other. It had been pointed out by Mr. M. B. Field that, apart from earths, the effect of capacity would be that anyone touching one pole of an insulated system would get nearly the full voltage. If damage occurred to the insulation, if was of first importance that the supply should be cut off. This would not, in the ordinary way, occur with an insulated system, but if the damage was sufficiently serious to cut off the supply, it would involve a great increase in pressure and tendency towards explosion. Reliability of supply in colliery work was most important as regarded winding and ventilation, which would not be affected by the tripping of underground devices, and therefore, however inconvenient, he thought tripping devices were advisable for the sake of safety.

Mr. H. W. Clothier said that any arrangement which allowed a damaged system to exist was faulty. He thought there was an obvious advantage in earthing the system, if only because of the limitation of potential rise in other parts when failure occurred. The author's first figure showed an unusual connection, pointing to the necessity of earthing the neutral of the generator, and his third figure pointed to the necessity of using more earth plates, but did not show that there were more objections to one system than another. The fourth figure he took to represent the Price system of protection, but it did not show the armouring of the cables which would be used if this system were applied. He disagreed with the author's remarks on cost of apparatus; the Price system cost little or nothing more than overload protection, and while small armoured cables cost 40 to 50 per cent. more than unarmoured, large ones cost only about 20 per cent. more. He considered that there should be sound metallic continuous armouring throughout, with earthed neutral, if only for automatic protection.

Mr. W. H. Patchell said earthing was really a question of the men who looked after the installation, rather than of protective devices. American opinion was about equally divided between the two systems, but often their earthing was of one phase and not of the neutral. While he thought the greatest weight of opinion was on the side of earthing, yet every case should be judged on its merits.

Mr. W. C. Mountain considered that earthing accounted for the great proportion of colliery installation troubles. He would avoid protective devices and heavy armoured cables to coal cutters and pumps, as heavy flexible cables were more liable to damage than good unarmoured cables. Machinery, switchcases, &c., should be earthed, and armoured cables might be advisable when good mechanical protection was necessary. He thought the real trouble in mining installations was due to the lack of attention and care of the apparatus.

Mr. J. F. C. Snell said he had come to the conclusion that it was imperative to earth the neutral of a three-phase system, and, if coupled with a good system of armouring, this minimised the risks of explosion and shock. It was necessary to protect the armouring from corrosion, and patchy armouring was of little use.

Mr. E. B. Wedmore agreed with the previous speaker's views, as also did Mr. H. M. Sayers, who contended that the earthed neutral served to give a definite potential to the system, and so limited the possibilities against which the designer had to provide.

Mr. Brazil said one was almost certain to get a shock from an insulated system, due to capacity, and it was dangerous to touch any pole, or even the neutral point, but one point at least was safe with an earthed system.

Mr. C. H. Wordingham and Mr. S. Z. de Ferranti both agreed as to the desirability of earthing the neutral point and providing a metallic sheathing throughout. The former stipulated for direct earthing, no resistances being interposed, but said the difficulty of getting an efficient earth had not been solved.

After an expression of agreement with earthing from Mr. S. Evershed, who occupied the chair in the absence of the President, the author briefly replied, emphasising the possibility of rapid deterioration and unreliability of armouring, on which leakage trips and other prohibitive devices depended, and pointing out that in many cases the shock due to capacity in an insulated system would be negligible!

Discussion at Newcastle.

Prof. Thornton believed that in America delta-connected transformers were becoming general. The impression in America was that earthing the neutral was simply putting a premium on breakdowns. Cases were known in which men had been killed with voltages as low as 80. There could be no doubt that above, say, 150 volts, there was a distinct danger even under ordinary circumstances, and he would be inclined to limit the lighting circuits to 120 volts. With higher pressures more precautions were taken to prevent accidents, because one knew without a doubt that fatal shocks could be received. He favoured armouring on cables for pressures of 3,000 volts and upwards. Many contractors objected to earthing the neutral, as it imposed an unnecessary strain on the insulation, and in many cases systems were laid down with insulated neutrals, but with a switch between the neutral point of the generators and earth, for testing purposes only. He denied that there was anything in the nature of a scare. There was really no need for uneasiness, because the percentage of accidents which were traceable to electricity, about which they knew a great deal, was infinitesimal compared with those due to the simple action of gravity, about which they knew nothing.

Mr. Wilson (Waste Heat Power Co.), referring to the alleged safety of the insulated neutral system, did not think that there was much in it, as on any system of considerable size there was a sufficient number of small leakages from all the phases to make it highly dangerous to touch any one phase, and the amount of danger would vary from day to day. With an earthed neutral everyone knew the danger of touching any one of the lines, and the known dangers were guarded against. The most frequent cause of damage to cables was falls from the roof, and this generally resulted in the armouring being driven into contact with the conductors, when, if the armouring was not efficiently earthed, the cable system was immediately in a highly dangerous state. He advocated either the balance system of protection or relay coils in series with the armouring.

Mr. Clothier (A. Reyrolle & Co.) was strongly in favour of earthing the neutral. The fact that with an insulated neutral a fault to earth did not interrupt a damaged circuit was a decided objection. A great advantage of working with an earthed neutral was that leakage detectors with their attendant drawbacks could be absolutely eliminated, and also there was no necessity for earthing devices in connection with the transformer system. He presumed that the author was in favour of earthing the neutral in collieries which took their power from large supply companies, and that the insulated neutral system would only be advocated for small isolated plants. The main point claimed for the insulated neutral was that the risk of shock was decreased even if insufficient and inadequate methods of protection were adopted, but little value could be attached to this claim, as the greater safety only applied at those times when the insulation throughout was perfect. The absolute necessity for automatic protection was now being realised, and a large American electrical power undertaking had already adopted the balanced system of protection for overhead transmission lines. To take advantage of the balanced system, under fault conditions, it was desirable to have the neutral earthed, as faults were then cleared simultaneously. With regard to limitation of voltage, especially for lighting work, the earthed neutral system had a considerable advantage in that a low-tension auto-transformer could be used having one side earthed, and in this way the voltage on the lamps need never exceed 50 volts above earth potential. With an insulated system, however, to give the same degree of safety, it would be necessary to have an ordinary transformer. The key-note of safety in mines was the enclosure of all live conductors in efficiently earthed metallic casing, and he agreed that the earthing should not be at one point of the system only, but in as many places as possible throughout the pit. Double armoured and compounded cable of, say, ·05 sq. in. section, having three cores, and suitable for 6,000 volts, was only about 45 per cent. dearer than unarmoured cable, while for larger sizes the difference was considerably less, and for single armoured, less still. Another reason for earthing the neutral was that the system permitted of more reliable protective systems. The system devised by Mr. B. Price, while giving instantaneous protection against faults to earth (the type of fault most liable to cause flashing), gave time-limit protection in the case of faults between phases or overloads. The advantage of leakage detectors was problematical, in that the detector only showed that there was a leak on the system, but gave no indication as to which feeder or section was at fault. While the electrical industry was to be congratulated on the small percentage of accidents occurring due to the application of electricity in mines, nevertheless over 20 lives were lost last year by accidents and explosions occasioned by small electrical failures.

Mr. F. O. Hunt (Newcastle) agreed that it was possible to get a severe shock from a completely insulated system, and in the case of a large system this might even be fatal. The limitation of voltage was not of much importance, as all the practical working voltages for power work were dangerous. He had carried out some experiments with regard to the voltage necessary to cause muscular fixation, and had found that, under favourable conditions, 30 volts was quite sufficient to cause this. The condition of danger began when a man could no longer save himself, and as he had found 30 volts to be the limit, anything above this must be considered dangerous. The instantaneous isolation of faulty sections for faults to earth was essential, as any time element allowed for a flash occurring, and, indeed, it was difficult to design any apparatus which would act in less than the time required to produce a flash. It seemed to have been assumed that leakage tripping devices were possible only when the neutral point was earthed, but he considered that it was quite possible to design apparatus which would trip out a section of an insulated system under the same conditions. With regard to the question of increased stresses on the insulation due to earthing the neutral, he pointed out that Mr. M. B. Field had shown that the condenser effect in cables had the same effect as earthing the neutral through high resistances. On the whole, he considered leakage indicators as an advantage, as they at least gave warning that the system had broken down somewhere.

Mr. Vesey Brown (Newcastle) had made it a rule to earth where possible, and also never to touch any conductor, whether earthed or not, as the maintenance of a good earth was extremely difficult.

Mr. C. Faraday Proctor (Ediswan Co.), referring to the question of efficient earthing, said that it was usually considered sufficient to earth to a waterpipe, but he had had a case where he could make a lamp glow dull red when connected between a waterpipe and a gaspipe.

Mr. Porter said that the modern practice, with regard to step-down transformers, was to have delta-connected primaries and star-connected secondaries, with the neutral point either earthed

or insulated depending upon circumstances, but preferably earthed. With regard to earthing the neutrals of the generators, he agreed that the best plan was that described by Mr. Rider, in which only one machine at a time had its neutral earthed, but the disadvantage of this was that a fault to earth severely strained the machine which happened to have its neutral earthed. Under certain circumstances, the strain on the generating station, due to earths on the cable system, could be mitigated by having a special transformer connected to the mains, this having a star-connected primary with the neutral point earthed and a delta-connected secondary with no external connections. In use, this device would level up the load on all three phases of the generator, even with an exceedingly heavy current passing between the fault and the star point of the transformer.

Mr. Wood replied very briefly to the points raised in the discussion; he agreed that each case had to be considered strictly on its merits, and thought that high-tension cables should be armoured; in cases in which the neutral was earthed the earthing should be carried out in as many places as possible, and every care should be taken that the earth circuit was retained in an efficient state.

Automatic Protective Switchgear for Colliery Service.

By E. B. Wedmore.

(*Abstract of paper read before the* Midland Institute of Mining, Civil and Mechanical Engineers *at Barnsley, December 15th*, 1909.)

Excerpt by permission from the *Transactions* of the Institution of Mining Engineers.

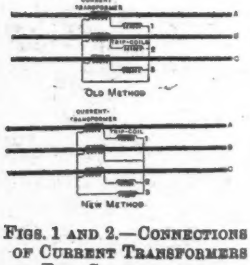
Since the publication of Mr. Robert Nelson's paper on "Electricity in Coal Mines," read at a meeting of the Institution of Mining Engineers held in London on May 27th, 1909, extensive experiments have been carried out by the firm with which the writer is connected, and the results have more than justified Mr. Nelson's anticipations. An account of these experiments is given in this paper, with some further considerations on the advantages of using armoured conductors, and on earthing the mid-point of three-phase generating plants.

The recommendations embodied in this paper apply principally to A.C. systems, and the discriminating devices in particular are suitable only for A.C. service.

On a completely insulated three-phase system, complete protection can be obtained by the use of automatic switches having tripping devices connected in two only of the three conductors, as any overload or fault-current passing through the third must needs return through one of the others, and hence through one of the trip-coils.

Where the mid-point of the system is earthed, a fourth conductor, namely, the earth, comes into use, and serves as a return conductor in case the insulation between one conductor and earth breaks down; therefore, in this case a tripping device is inserted in each phase, so as to obtain complete protection. This arrangement gives equal protection against overloads, faults between phases, and faults to earth.

On high-tension circuits it is customary to employ current-transformers to excite the trip-coils; where this is done it is possible, by a simple artifice introduced by the writer, to obtain independent control of the adjustments for operation on overloads



Figs. 1 and 2.—Connections of Current Transformers to Trip-Coils.

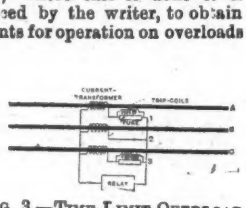


Fig. 3.—Time-Limit Overload Trip, with Instantaneous Leakage-Trip.

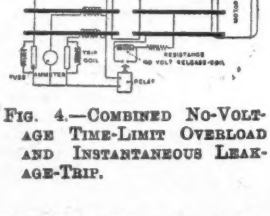


Fig. 4.—Combined No-Voltage Time-Limit Overload and Instantaneous Leakage-Trip.

and on leaks to earth. This consists in the transfer of one trip-coil from the usual position into a return circuit common to the three current-transformers. This coil will then be operative only on faults to earth, and the other two will take care of all overloads or faults between phases. Fig. 1 shows the recognised method of connecting three trip-coils to three current-transformers, and fig. 2 that proposed by the writer.

By the use of this device independent control is obtained of the adjustments for operation on faults to earth and on over-loads. For example, the overload coils at 1 and 2 may be controlled by a delaying device adjusted to operate on a sustained overload, but to prevent the switch from operating on a momentary overload. At the same time, the third trip-coil may be adjusted to operate instantaneously on a leakage current of less than normal load.

Mr. Nelson's suggestion consisted substantially in the provision of devices capable of automatically disconnecting feeders in case of a small leak. By the use of a sensitive relay at point 3, the protection required is obtained without the use of the special transformer, carrying all three conductors, previously suggested for this service.

Where a sensitive relay is employed, it is necessary to ensure similarity of the three current transformers, as if their transformation ratios were to differ, say, on a momentary overload, a corresponding current would flow in the relay, representing a spurious leak. This current due to internal differences, is kept within limits by using a form of overload device which normally makes no demand on the current-transformer. This takes the form of a trip-coil shunted by a low-resistance fuse. This fuse prevents effectively the trip-coil from operating until an overload of sufficient magnitude has lasted sufficient time to melt the fuse, when the coil instantly takes the current and trips the switch. These fuses practically short-circuit the transformers, as may be seen in fig. 3, and this materially reduces the effect of any internal difference between them.

Where relays are employed, the oil-switches are operated by trip-coils excited off any convenient source of supply, preferably independent of the A.C. supply, such, for instance, as the exciter circuits or a small battery. Where individual motor or other circuits are furnished with a low-voltage release, this may be utilised for the purpose, the relay short-circuiting the winding; and a current-limiting resistance is used in series, as shown in fig. 4.

When installed in this way, the use of leakage devices involves a minimum of addition to the usual equipment. The current-transformers provided for the usual instrument equipment serve also for the automatics, and the relays—only one of which is required on each three-phase main—are the principal addition.

Should such a device be installed on any feeder, any leak to earth, not only in that feeder, but in any distributing circuit fed by that feeder, or in any individual motor or other device energised by that feeder, will be effective in cutting off the supply. Such a course cannot be contemplated in case of a leak developing, say, on the terminal board of a small motor.

The writer proposes to overcome this difficulty by the use of leakage devices in series. In addition to that on the main feeder, similar devices may be furnished on every branch feeder from a distributing centre below ground, and again on each individual motor or other device, or, on occasion, behind groups of small motors.

To render this arrangement effective, some discriminating arrangement is necessary, as a leak on any one motor will affect all the devices in series, right back to the generating plant. This may be obtained by grading the settings of the leakage devices, using a fine setting for individual motors, a heavier setting for branch circuits, and a still heavier setting for the main feeder. For example, on a 3,000-volt circuit, a 100-ampere feeder carrying say, 500 H.P., may be equipped with a relay operating at 10 amperes. The switch controlling an individual circuit branching from the same and carrying 25 amperes may be set to open on a leak of 1½ amperes, and an individual motor of, say, 30 H.P., may have an automatic operating at ½ ampere; and a lower setting than this is obtainable.

In the event of a leak being caused in an individual motor or circuit by deterioration, abrasion, corrosion, presence of dirt, or like causes, the circuit will be disconnected from the supply immediately the leak reaches the predetermined fraction of an ampere.

Tests have shown that discriminating action can be obtained in some measure in the majority of instances of severe damage, even on high-tension systems; whilst on systems of medium voltage the shut-down is confined to the damaged circuit in nearly every instance.

Turning now to the important question of reduction of risks from explosion and fire, a number of comparative tests have been made, first, with leakage relays in use, and, secondly, without such relays. In order that fire and smoke might issue, it was found

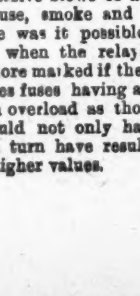


Fig. 5.—Typical Main-Feeder Equipment, with Leakage Relay.

necessary to damage the cable very severely, and the most effective means proved to be successive blows of a heavy hammer. When the relays were not in use, smoke and flame issued in several instances; but in no case was it possible to produce any sign of flame, or even of smoke, when the relays were in service. The arcing would have been more marked if the branch circuit had been protected by common series fuses having a time-limit three or four times as great on a given overload as those employed in shunt to the trip-coils, as this would not only have given more time for combustion but would in turn have resulted in the short-circuit currents reaching much higher values.

Fig. 5 is an illustration of a typical main-feeder panel, showing an oil switch with trip coils, and a leakage relay. The latter consists of an electromagnet and armature, arranged to close an auxiliary circuit by means of platinum contacts carried by the armature.

Fig. 6 illustrates a typical gate-end switch, suitable for 500 to 2,000 volts, with receiving box for armoured cable, plug-fitting for armoured trailing cable interlocked with oil switch, and a compartment for current transformers and relay. A distributing board can be built of a group of similar boxes.

It is generally recognised that the dangers attending the use of electricity in mines are greater in several respects than those met with in other industrial applications, and this calls for the use of greater safeguards, both in the way of automatics and better maintenance, which involves supervision and inspection.

Danger may be reduced to a minimum if armoured cables be employed, whereby all live parts are enclosed throughout, from the main switchboard to the individual motors, by a continuous metallic covering, well earthed. Every switch, motor, or other device, should be ironclad and provided with substantial fittings obtainable in the open market for making mechanically and electrically sound connections between the metallic cases and the metallic armouring on the cables.

Fig. 6, for example, shows a typical joint between the cable armouring and a metallic case in which the armouring is firmly

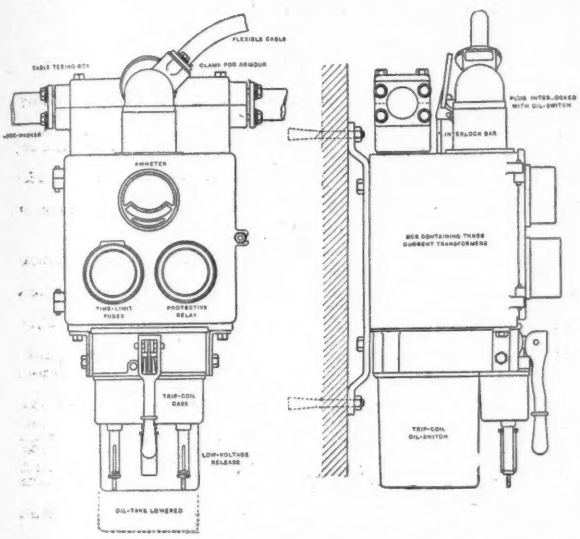


Fig. 6.—Front and End Elevations of Gate-End Switch.

held under a solid metal clamping plate. Several types of flexible cables suitable for this system are obtainable with metallic armouring.

If this system be employed and efficiently carried out with apparatus and material designed for the purpose, all leakage currents will be confined to the metallic covering, thus removing all risks except those arising from actual rupture of, or severe arcing in, the cable. If automatic leakage devices be employed, the danger arising from these risks also is reduced to a minimum.

Where leakage relays are employed it is possible to employ a resistance in the earth-connection, which limits the leakage current under the severest conditions to a fraction of normal load. Such a connection will not prevent the operation of the leakage devices with certainty, and will serve under normal conditions to hold the mid-point of the system at earth potential; neither will it interfere with the function of the earth-connection in preventing the development of small static disturbances which, if they arise, will search out the weak points of the system and cause faults to develop.

The use of the armoured system with the neutral earthed ensures every defect receiving prompt attention, as every defective portion is promptly isolated and put out of service; and this tends to ensure efficient supervision, inspection and maintenance.

The purchase of good material and appliances is undoubtedly the surest way of automatically reducing danger and controlling continuity of supply, and amongst the latter may well be included appliances designed to meet the risks peculiar to the mining industry.

In the discussion, the President (Mr. M. H. Habershon) said that the direct-current system had been in operation for coal-cutting machinery for probably 16 or 18 years; it had been a very good servant, and, in his opinion, was not likely to be superseded. The adoption of the three-phase system appeared to require the use of armoured cables, and this necessitated very careful attention to the question of earthing; hence the elaborate devices which had just been described. He had taken out figures as to the number of accidents reported to the Inspectors of Mines during a period of nine years—from 1900 to 1908—and had found that 74 fatal accidents had been reported as being due to the use of electricity at collieries, of which number 63 had occurred underground, being an average of 7 lives lost per annum. He did not think that the number was sufficient to give rise to the present scare, or to cause colliery managers to throw on one side the direct current which had been so useful to them for many years past. The more mining engineers looked into this question, the more they would realise that the difficulty of securing and of maintaining the continuous earthing of the armouring of the three-phase cables, even by means of clamps, was very great; and he held a strong opinion that the danger was only increased, especially for coal-cutting cables in goaf roads, by the introduction of armouring.

Mr. H. Ravenshaw (London) asked whether the safety-device described by Mr. Wedmore could be used to detect any want of balance in a motor circuit. Trouble very frequently arose from want of balance, owing to defective contact at the controllers of three-phase motors. Switches with no-voltage release had been in regular use in connection with direct-current for quite 15 years, but there had always been a difficulty in obtaining similar devices for A.C. switches. He had, however, always employed them.

Mr. E. B. Wedmore, in the course of his reply, said that the leakage relay gave an absolute indication of leakage, without regard to the balance of power in the three phases. So long as the whole of the outgoing current returned by the cables, there would be no resultant current in the relay circuit. The arrangement shown in fig. 2 instead of introducing additional complications when employed with overload time-limit devices, gave a higher degree of protection than other arrangements previously employed, although requiring less apparatus. So far as he had been able to observe in the public reports, accidents occurring on systems where armoured cables were employed had been due to the use of apparatus not suitably designed for the purpose. By the employment of a completely-armoured system, carried out with apparatus designed to ensure the continuity of the armouring, and combined with cut-outs acting instantaneously on the occurrence of faults, the large majority of such accidents as had occurred in the past would be prevented. At the moment, there was no equally effective protection available for direct-current service.

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

9,318. "Improvements in devices for igniting explosive charges in internal combustion engines." W. Swaine and C. L. Bruce. April 18th.

9,319. "Improvements in or relating to electric cable conductors." W. E. Hitch. April 18th.

9,341. "Improvements relating to systems of and apparatus for electric metering." April 18th.

9,355. "Improved system of connections for an electric lift or similar intermittently working plant." C. Stigler. April 18th. (Complete.)

9,364. "Device for closing an electric circuit automatically at a temperature variable at will." F. E. Bourck. April 18th. (Complete.)

9,373. "Improvements in or relating to the regulation of dynamo-electric machines." D. Balachowsky and P. Caire. (Application for Patent of Addition to No. 23,742/02.) (Date applied for under Sec. 91 of the Act, April 26th, 1909, being date of application in France.) April 18th. (Complete)

9,387. "Improvements in electric arc lamps." H. J. Booker, J. C. Russ and J. & H. Grevener. April 18th.

9,397. "Improvements in and relating to the electro-deposition of metals or to like operations." B. Bradley. April 18th.

9,399. "Improvements in or relating to electric switches." P. Druseidt. (Date applied for under Sec. 91 of the Act, May 29th, 1909, being date of application in Germany.) April 18th. (Complete.)

9,459. "Electric induction instruments." J. H. Reid. April 19th. (Complete.)

9,461. "Electro-medical instruments." N. Cole. April 19th. (Complete)

9,470. "Improvements in electrical mercury switches operated by a vehicle passing above a railway." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt-Ges., Germany.) April 19th. (Complete.)

9,474. "Ferro electrodes." H. J. Marsden. April 19th.

9,488. "Improvements in devices for automatically controlling the ignition period in magneto electric ignition apparatus." W. P. Thompson. (Ernst Eisemann & Co., G m.b.H., Germany.) April 19th. (Complete.)

9,491. "Improvements in or relating to induction coils for electric cables." H. W. Malcolm and R. Appleyard. April 19th.

9,496. "Improvements in electric magnetic devices for controlling the admission of carburetting liquid to internal combustion engines." L. L. Bellem and G. J. Baptiste Bregeras. (Date applied for under Sec. 91 of the Act, April 24th, 1909, being date of application in France.) April 19th. (Complete.)

9,517. "Improvements in and relating to miners' electric lamps." O. Oldham. April 19th.

9,530. "Improvements in or relating to electric controlling and regulating apparatus." R. Rankin. April 20th.

9,538. "Improvements relating to apparatus for electrical driving of roundabout and other cars running on a fixed course." W. J. Affleck and J. Pilling. April 20th.

9,543. "Device for indicating the pressure of fire-damp by means of a selenium cell and a safety lamp." H. Freise. (Date applied for under Sec. 91 of the Act, April 27th, 1909, being date of application in Germany.) April 20th. (Complete.)

9,547. "Improvements in electric lamp shade attachments." H. A. Beard and J. W. Townsend. April 20th.

9,575. "Electric weft feeler for use in looms for weaving." J. Bright & Bros., Ltd., and J. W. Whatmouth. April 20th.

9,580. "Improvements in and relating to alternating-current power measurement and instruments for the same." R. Arno. April 20th. (Complete.)

9,592. "Improved means for producing electric waves." J. Rabinsohn. April 20th.

9,603. "Improvements relating to protective apparatus for alternating-current distributing systems." G. Harlow and K. M. Faye-Hansen. April 20th.

9,611. "Improvements in electric ovens." H. Gray. April 20th.

9,615. "Improvements in incandescent electric lamps." A. W. Beuttell (Date applied for under Sec. 91 of the Act, April 21st, 1909, being date of application in United States.) April 20th. (Complete.)

9,634. "Circuits for registers in automatic telephone exchanges." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) April 20th. (Complete.)

9,637. "Improvements in high frequency alternators." E. F. W. Alexanderson. (Date applied for under Sec. 91 of the Act, April 26th, 1909, being date of application in United States.) April 20th. (Complete.)

9,644. "Electric fire alarm." P. Kukiolka. April 20th. (Complete.)

9,647. "Improvements in or relating to alternating-current conductors." H. W. Malcolm and R. Appleyard. April 20th. (Complete.)

9,649. "Improvements in the magnetic separation of ores or the like by the wet method." Murex Magnetic Co., Ltd., and M. R. Anthony. April 20th.

9,674. "Means for the methods of limiting the current on a short-circuit." A. M. Taylor. April 21st.

9,697. "Improvements in means for ringing a polarised electric bell." W. J. Addison and E. F. Brown. April 21st.

9,703. "Mercury electric switch with time element for automatic periodical change over." E. Slater. April 21st.

9,722. "Improvements in or relating to name indicators for telephone users and like purposes." M. W. Wright. April 21st.

9,735. "Improvements in controllers for electric motors." Adams Manufacturing Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) April 21st. (Complete.)

9,740. "Improvements in cells or cases for electric batteries." Float Electric Co., Ltd., and W. J. L. Sandy. April 21st.

9,772. "Improvements in or relating to magneto-electric current generators." A. P. Juston. (Date applied for under Sec. 91 of the Act, May 6th, 1909, being date of application in France.) April 21st. (Complete.)

9,809. "Improvements relating to electrical sparking plugs." F. B. Lodge and A. Lodge (trading as Lodge Bros. & Co.) April 22nd.

9,819. "Process for rendering aluminium more suitable for electric conductors." A. H. Mayes. April 22nd.

9,832. "Improvements in and connected with electric condensers." E. Wilson and W. H. Wilson. (Date applied for under Rule 13, June 9th, 1909. An invention comprised in application No. 13,509, dated June 9th, 1909.) April 22nd.

9,858. "New or improved material for electrical insulation and a new or improved process for the manufacture of the said material." W. F. Reid. April 22nd.

9,888. "Improvements in automatic safety catches for loads of all kinds particularly for arc lamps." F. Koller. April 22nd.

9,890. "Improvements in electric switches." Adams Manufacturing Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) April 22nd. (Complete.)

9,897. "Improvements relating to electric furnaces." J. Harden. April 23rd.

9,923. "Improvements in electric ignition distributors." R. F. Hall. April 23rd.

9,924. "Improvements in dynamo armatures," R. F. Hall. April 23rd.

9,925. "Improvements in automatic cut-outs for electric generators." R. F. Hall. April 23rd.

9,926. "Improved system of electric distribution." R. F. Hall. April 23rd.

9,933. "Improved dielectric filling or grouting composition." R. C Sharp. April 23rd.

EXPIRING PATENTS.

(*Continued from page 720.*)

10,124. May 12th, 1896. "Electric distribution." J. Devonshire, London (C. P. Steinmetz, U.S.A.) Relates to "polyphase" distribution and to the arrangement of an "equalising" or "balancing" wire.

10,718. May 18th, 1896. "Secondary batteries." H. O. Tudor, Luxemburg. Plates or electrodes are manufactured by charging lead plates, which may have a thin coating of lead oxide or salts thereon, as positive electrodes in very weak sulphuric acid for the purpose of forming a layer of lead oxide containing sulphate. The charging at this stage is intermittent. The plates are then reduced in the same solution by charging them as negative electrodes, and these are finally reconverted into positive electrodes by continually charging and discharging them in stronger acid than that previously employed.

11,958. June 2nd, 1893. "Targets and apparatus for shooting practice." J. L. McCullough, Brooklyn, N.Y., U.S.A. Relates to electrical apparatus for indicating whether the weapon is properly pointed at the target when the trigger is pulled. An arm carrying the imitation gun is mounted in a ball and socket joint and carries a metal spring contact tip, which moves over a disk of insulating material. When the gun is pointed correctly at one of the targets and the trigger is pulled, an electric circuit is completed and an electromagnet allows the target to fall. The trigger, when pulled, strikes a metal contact piece carried by a pivoted block or lever of insulating material, and first closes, and then breaks the electric circuit. Every time the trigger is pulled, a pointer is moved over a dial by an electromagnet. A movable cymbal carried by an armature of an electromagnet in the circuit is also clashed against a fixed cymbal whenever the circuit is closed by pulling the trigger. The movement of the circuit closing tip may be increased by means of a multiplying lever mounted on a ball and socket joint.

12,039. June 2nd, 1896. "Electric signalling systems." G. Marconi, Westbourne Park, Middlesex. Signals are sent by means of a Hertz radiator, and are received by a tuned receiver, including a tube of filings, coherer, &c., the circuit of which is shunted by the circuit of the signal-receiving instrument of ordinary type or a relay. The receiver is described as having straight or curved tin-foil plates connected to a small glass tube fitted with silver plungers, between which the metal filings are placed; a series of the blocks and filing sections may be employed. The tube is tapped by a trembler either continuously or on receipt of each signal. The transmitter consists preferably of two pair of balls, the external balls being connected to the coil, while the central ones, preferably separated by oil, are placed near enough to spark.

14,345. June 29th, 1896. "Looms." T. A. B. Carver, Hornsey. Patent void through non-payment of renewal fee for the 14th year. Petition filed for extension of term, December 30th, 1909. Electric jacquards. The horizontal needles which operate the hooks are reciprocated sideways by springs. The keepers of magnets are reciprocated vertically. When a magnet is energised, the keeper is held up, obstructing one of the needles so that the corresponding hook is engaged by a knife. The springs yield when the needles come into contact with the keepers, but are strong enough to push the keepers out of contact with the magnets, so that they fall when the magnets are de-energised and the needles return.

14,346. June 29th, 1896. "Looms." T. A. B. Carver, Hornsey. Electric jacquards. Relates to the production of twill effects. The needles are actuated by electromagnets, as described in the previous specification No. 14,345, A.D. 1896. Each electromagnet has two windings, the circuits being arranged to neutralise one another when both are completed. If, therefore, the second circuits of any set of needles are completed, the action of the needles of that set is reversed.

18,617. August 22nd, 1896. "Dynamo-electric machines." F. J. Chaplin, Birmingham. Brushes are made by folding together two sheets of copper wire gauze, the outer sheet being cut diagonally to the direction of the wires, while the inner sheet is cut on the straight. They may be provided with a crimped wire core of the kind described in specification No. 20,078, A.D. 1895.

16,057. July 20th, 1896. "Electrolysis." C. Kellner, Vienna. Electrodes for producing high-current densities are formed of platinum wires secured to each side of a support of dielectric material, and connected together by a copper bolt. The wires must be at such a distance apart that the lines of force radiating from each wire upon the nearest electrode will fall outside the range of those of the neighbouring wire. The electrodes are supported in the cell within grooved strips of dielectric materials. The cell is provided with a central inlet opening and with lateral gutters for the electrolysed liquid.

16,445 July 24th, 1896. "Railway points and signals." Siemens Bros. and Co., Ltd., Westminster. (Siemens & Halske, Berlin.) Relates to improvements on the invention described in specifications No. 4,976, A.D. 1893, and No. 11,025, A.D. 1895. The control of the actuating motor is now separated from that of the point rails and their connections by means of a fourth lead in addition to the three leads, magnet and lever, previously described. The fourth lead forms the winding of an electromagnet in which current indicates that the connections between the motor and points, and also the points are in order. The armature of the magnet has contacts, &c., for signal circuits, and also an arrangement of contact is provided to avoid sparking, but this may be replaced by using a separate circuit for the extra lead. The reversing mechanism of the motor is now arranged on the motor itself to act after a definite number of revolutions, and is not operated from the points. The motor can thus complete the reversal circuits if the points do not work properly.

(To be continued.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1909.

Telephone Switchboards. W. Aitken and British Insulated and Helsby Cables, Ltd. 16,642. July 16th.

Insulation of Metallic Threads. K. Newton. (Farbenfabriken vorm. F. Bayer & Co.) 18,193. August 6th. (Date applied for under Rule 13, May 13th, 1909.)

Self-Driving Electric Heat and Fluid Pressure Motor. G. E. A. Holdsworth. 18,511. August 11th.

Dual Ignition Apparatus especially Suitable for Internal-Combustion Engines. G. Fuller and B. J. Moore. 19,501. August 26th.

Electric Batteries. G. Fuller. 19,914. August 31st.

Electric Lamp Fittings. J. Gray. (F. J. Seabolt, U.S.A.) 21,854. September 24th.

Automatic Telephone Exchanges. E. Neuhold. 22,596. October 4th. (Date applied for under International Convention, April 7th, 1909.)

Cathodes for Röntgen-Ray Tubes and like Apparatus. R. Green. 23,316. October 12th.

Detector of Electromagnetic Waves. A. G. Rossi. 23,628. October 15th.

Clamping and Supporting Devices for Electrical Condensers. Siemens Bros. & Co. and C. R. Riber. 23,811. October 18th.

Ceiling Roses for Electric Lamps. L. M. Waterhouse. 24,769. October 28th.

Current Collector for Electrically-Propelled Vehicles. W. Köhler. 26,907. November 15th. (Date applied for under International Convention, October 4th, 1909. Application for Patent of Addition to No. 26,347 of 1909.)

Electric Storage Battery Plates. Accumulatoren-Fabrik Akt.-Ges. 27,221. November 23rd. (Date applied for under International Convention, February 11th, 1909.)

Rotating Field-Magnets for Turbo-Generators. O. T. Blathy. 27,359. November 23rd.

Electric Accumulator Sub-Stations Fed from Alternating-Current Systems. A. M. Taylor. 2,147. January 27th. (Cognate applications, 2,385 of 1909 and 5,768 of 1909.)

Means for Rendering Constant the Voltage of Dynamos for Electric Lighting and Charging. O. M. Shepherd. 7,058. March 24th.

Couplings or Connections for Electric Conductors or Cables and the like. A. G. Brookes. (Thomas & Betts Co.) 7,576. March 30th.

Diaphragm Condensers especially Adapted for the Purpose of Wireless Telephony. W. Burstyn 7,906. April 2nd. (Date applied for under International Convention, February 16th, 1909.)

Electrical Distributing Systems. A. Spencer. 8,165. April 5th. (Request under Sec. 19 not granted.)

Electric Coal-Cutting Machines. T. Thomson. 8,694. April 13th.

Outgoing Telegraph Signal Recorders. A. W. Shawman. 9,686. April 23rd.

Shade-Holders for Incandescent Electric Lamps. W. R. Mackay. 9,819. April 26th.

Electric Time Switches. H. H. S. Marsh. 10,940. May 8th.

Apparatus for the Production and Maintenance of Long Electric Arcs for Effecting Reaction Between Gases. G. W. Johnson. (Chemische Fabrik Griesheim-Elektron.) 11,060. May 10th.

Insulating of Electric Cables. British Insulated and Helsby Cables, Ltd. F. A. Cole and J. Shaw. 11,135. May 11th.

Electrical Device for Transmitting Angular Movements to a Distance. F. Spalazzi. 11,838. May 14th. (Dated May 13th, 1909.)

Ceiling Roses, Junction Boxes, Conduit Boxes and like Electric Fittings. S. Johnston. 11,773. May 19th.

Electric Rheostats, Motor Starters and the like. A. H. Curtis, J. T. Mould and Adams Mfg. Co. 12,142. June 4th.

Electric Arc Lamps. H. J. J. Jaburg. 15,880. July 7th. (Date applied for under International Convention, May 26th, 1908; originally included in 7,471 of 1909.)

Production of Lighting Effects on the Stage by Means of High-Tension Currents of High Frequency. F. Zhaniel. 16,109. July 13th. (Date applied for under International Convention, July 16th, 1908.)

1910.

Devices for Cooling the Windings of the Rotors of Dynamo-Electric Machinery. Siemens Bros. Dynamo Works, Ltd., and M. Kloss. (Siemens Schuckertwerke Ges.) 1,404. January 19th. (Application for Patent of Addition to No. 1,679, 1909.)

Telephone Transmitters. A. J. Boult. (B. C. Maxwell, U.S.A.) 1,707. January 22nd.

Electric Hoists. H. J. Marshall. 457. January 7th.

Automatic Electromagnetic Regulators. Soc. Anon. Ateliers Jasper and G. Meller. 1,087. January 15th. (Date applied for under International Convention, January 16th, 1909.)

Control of Alternating-Current Electric Motors. British Thomson-Houston Co. (General Electric Co.) 5,041. February 28th. (Date applied for under Rule 13, March 24th, 1909.)

Electric Fly Switches. C. J. Baker. 17,561. July 28th.